INDIAN FOOD INDUSTRY

VOLUME 15
1/1996
JANUARY/
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A PUBLICATION OF ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (INDIA)

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* Affiliated to the Institute of Food Technologists, Chicago, Illinois, U.S.A.
* The Association is a professional and educational organization of Food Scientists and Technologists, with its headquarters at Mysore.
* The chapters of the Association the association are located at Bangalore, Bhopal, Bombay, Calcutta, Delhi, Hisar, Hyderabad, Jabalpur, Jaipur, Jammu, Kanpur, Karnal, Kharagpur, Ludhiana, Madras, Manipur, Nagpur, Pantnagar, Parbhani, Pune and Thiruvananthapuram.

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* Advancement of all the aspects of Science and Technology relating to production, processing and distribution of food, with the ultimate objective to serve humanity through better food.
* Promotion of research, development and training in the Science, Technology and Engineering of Food.
* To provide a forum for exchange, discussion and dissemination of knowledge and current developments, especially among Food Scientists and Technologists as well as the Public and Society at large.

Major activities :

* Publication of 'Journal of Food Science and Technology' (bi- monthly) and 'Indian Food Industry' (bi-monthly),
* Holding symposia/conventions on different aspects of Food Science, Technology and Engineering
* Arranging Lectures and Seminars for the benefit of Members and the Public.

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* Membership is open to graduates and diploma holders in Food Science, Technology and Engineering as well as to those engaged in these professional activities.
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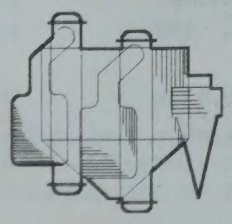

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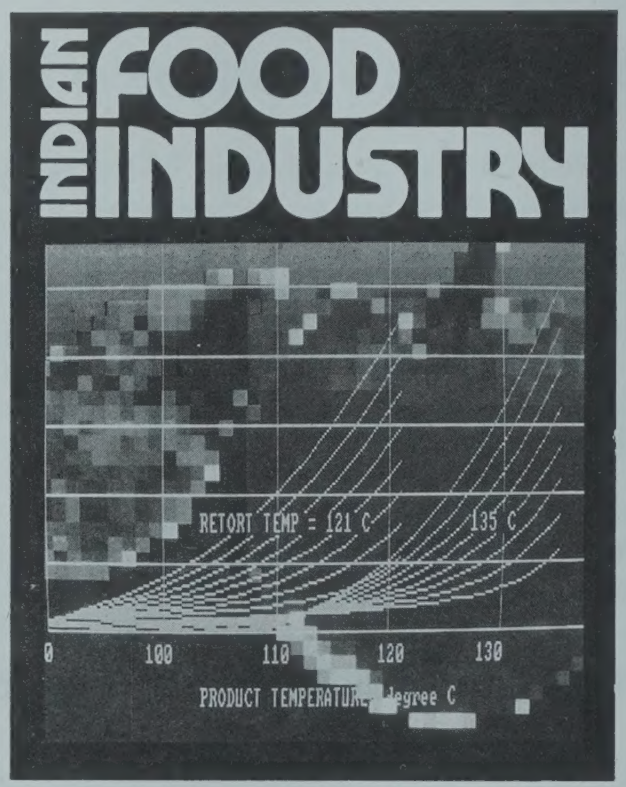

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Review articles, technology papers based on R&D work and reports on various aspects concerning food industry are welcome from food scientists and technologists from industry, research institutions and other related organisations. Contributors are advised to provide good quality illustrations in the form of charts and photographs along with the manuscripts. The Editorial Board reserves the right to edit the manuscripts in order to make them suitable for publication in the journal.

Food industries may send information (suitably illustrated with photographs) about their new products, machinery, business ventures and other developments, which will be published on the discretion of the Editorial Board.

Subscription : All members of AFST(I) are entitled to receive the **Indian Food Industry** journal regularly free of cost, if they opt for it. Members who are receiving **Journal of Food Science and Technology** and desirous of changing over to **Indian Food Industry,** can do so by sending a formal request to the Executive Secretary, AFST(I). Alternatively, they can subscribe to **Indian Food Industry** by paying an additional amount of Rs 50. The regular subscription rates for the journal are as follows :

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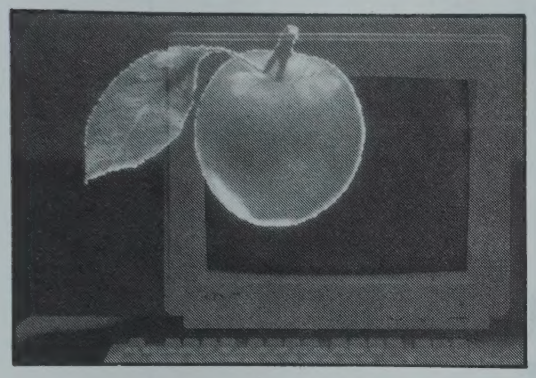

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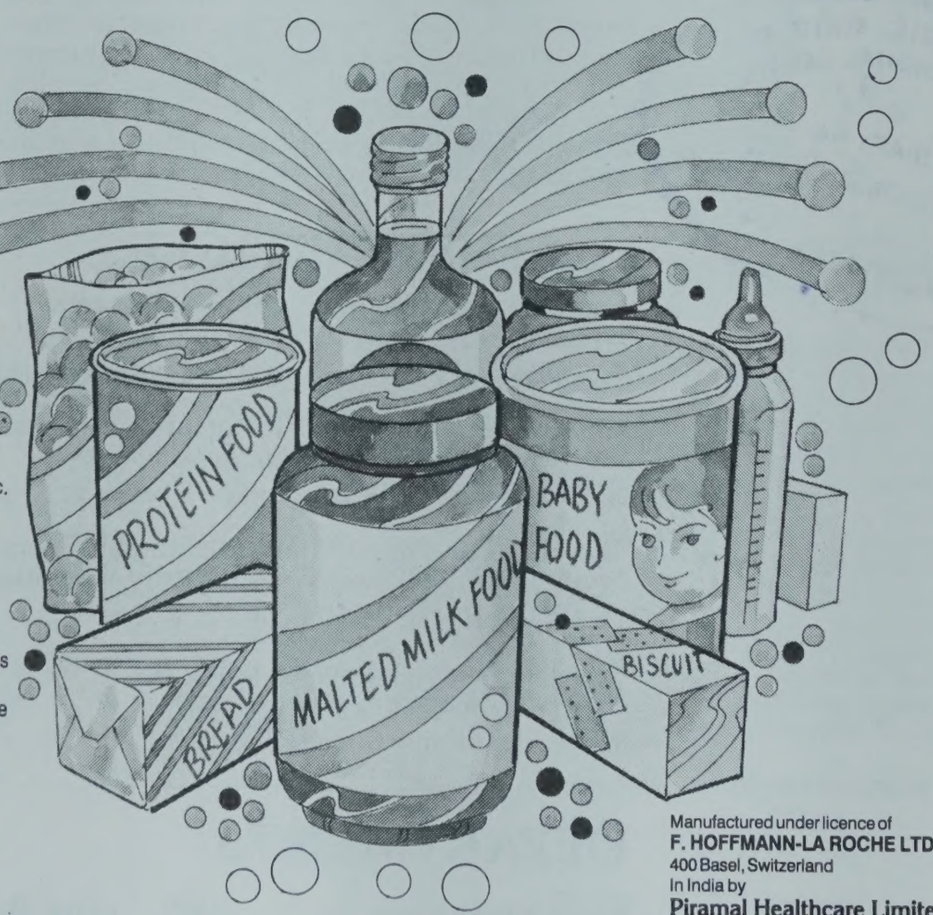

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EDITORIAL

It has been the endeavour of Association of Food Scientists and Technologists (India) as a professional association to cater to the information needs of the wide spectra of food processing industries and the professional and managerial minds in the industry. Principally, the channels have been the organisation of seminars, conventions at regional, national and international levels and the two journals, viz., Journal of Food Science and Technology *and* Indian Food Industry. *The emphasis and character of* Indian Food Industry *are more towards the techno-commercial aspects of the food processing industry, and we have been over the years enjoying overwhelming support of the valuable and discerning readership and contributors of articles of high standard from a vast array of authors, representing various dimensions.*

The journal has been able to establish respectability due to the technical excellence and professionalism of a dedicated editorial board, and the administrative support of the Association and patrons. The journal needs to scale new heights in quality and readership and no doubt the task is challenging and exciting as well.

I, along with a group of dedicated scientific minds, enjoyed the pride and privilege of guiding the Editorial Board of IFI over the last 3 years, and strove hard to maintain the good tradition and standard handed over by our predecessors.

Now, it is time to look for new directions and infusion of fresh thoughts and style to make the journal play bigger and challenging roles in the years ahead. With this singular objective, I and my colleagues lay down our responsibilities as members of the Editorial Board. On this occasion, we gratefully acknowledge the cooperation, guidance and assistance we received from every one, in our tasks. The journal looks forward to continued patronage from our esteemed readers, authors, advertisers and the members of AFST(I).

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INDUSTRY NEWS

Towards India, US Joint Ventures in Food Processing

A high-power US delegation will soon visit India to explore investment opportunities in the food processing sector.

The team will concentrate on cereals, fruits and vegetable processing, meat, poultry and dairy industry.

This was conveyed to the Minister of Food Processing, during his recent tour to the US by the State Department of Commerce. Both Governments decided to strive for developing more collaborations between Indian and the US companies in the food processing sector.

It was hinted that the US Secretary for Commerce may visit India shortly to review the progress.

Besides 14 Indian companies, a very large number of prominent US companies participated in a Mega Show, the food and dairy exposition and held one-to-one discussions with their Indian counterparts for technology transfer and joint venture opportunities.

The Indian team participated in a special session at New York on the Indian agro business sector organized by the Asia Society. On the occasion, a number of US companies expressed willingness for transferring the latest technology in food processing.

The delegation visited Florida to see the latest soya protein manufacturing technology and the possibilities of its transfer were discussed. The delegation included Mr. C. K. Basu, Joint Secretary in the Ministry of Food processing and Mr Gokul Patnayak, Chairman of APEDA.

Project Setting on a Thaw

The Indian food processing industry has been busy trying to cash in on the abundant stock of fruits and vegetables in the country, particularly where there seems a potential of export of processed foods.

ANS Agro plans to venture into exports of frozen fruits and vegetables by setting up a 100 per cent EoU. To meet the project cost, it is coming out with a Rs 3.46 crore par issue.

ANS Agro is setting up a 100 per cent EoU for frozen fruits, vegetables and frozen pulp at Haryana having an installed capacity of 5100 mt per annum. The project proposes to use state-of- art technology termed as individually quick frozen (IQF) for its production in collaboration with Kuhlzentrum Mariental of Germany. Marietal India, a joint venture of collaborators in India, will provide the engineering consultancy.

The cost of this project amounting Rs 15.33 crores would be met mostly by raising Rs 9.25 crores of equity which includes Rs 4.6 crores from the public. The rest of the funds are raised as loan from IDBI. Post issue equity will be Rs 9.25 crores.

IQF is a technique relatively new to India. However, as the company is acquiring the technology from its German collaborators, it need not worry on that account. The company might face loss through wastage, as the raw material is a perishable commodity. Natural calamities may step in and affect the supply of the raw materials and thereby the profitability of the company. The commencement of production is expected to begin by April '96.

Demand for Indian Coffee in US

Indian coffee is beginning to make its presence felt in the American market dominated by big players like Brazil, Venezuela and Colombia.

A senior Indian trade official, who recently spoke at a major American coffee convention, said India has at last acquired a distinct profile in the American coffee business - a fact that has not gone down well with the South American giants.

Other players in the US market are Vietnam, Indonesia, Kenya and Uganda, all of whom are ahead of India in the volume of exports. India accounts for barely 1 per cent of US coffee imports. The Coffee Board of Kenya and India's STC were the only state- controlled organizations that participated in this year's GCA convention, a corporate event where advertising by countries is prohibited.

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India was always classified by the US coffee Industry buffs as one of the "other" categories after Brazil and Colombia. "Now they recognize that we have quality coffee and we are here," Prashad, Marketing Director, State Trading Corporation, said.

Before 1991, India was exporting about 4,000 odd metric tonnes of coffee to the US with a value of about Rs 7000 crores during last year, India was exporting about 11,000 tonnes valued at about $28.75 millions. STC accounts for 11 per cent of trade.

Most of the Indian coffee that is exported to the US is of the filler variety - neutral flavour beans that are used to fill a blend in which the aroma comes from a mixture of other varieties of beans. Filler beans make up 40 per cent of a blend.

Coffee in India is grown mainly in the hill ranges of Karnataka, Kerala and Tamil Nadu. The area under coffee has grown from 92,500 hectares in 1950-51 to 292,500 hectares in 1994-95. The total production has increased from 189,000 tonnes in 1950-51 to 230,000 tonnes in 1995-96. Karnataka accounts for 70 per cent of the crop.

NCDC, NHB to Part-finance A Horticulture Project in Karnataka

A Rs 100 crore project for the establishment of a state-level horticulture federation in Karnataka is on the anvil.

The National Co-operative Development Corporation (NCDC) and the National Horticulture Board (NHB) have agreed, in principle, to finance about 76.5 per cent of the project cost. The balance is slated to come from the State Government and the beneficiaries.

The Karnataka State Horticultural Co-operative Marketing Federation (KSHCMF), the apex body for marketing and export of horticulture produce is likely to commence operations as early as 1996.

The KSHCMF will essentially be a three-tier structure, with the federation at the apex, followed by the Horticulture Produce Co-operative Marketing Societies (Hopcoms), and finally, the divisional/regional retail outlets at the base.

A decentralized approach and the concept of each unit at every level as a profit centre will be the key features of this enterprise.

Currently, the Hopcoms network handles only about 170 tonnes of fruits and vegetables daily, barely covering eight districts. However, according to latest available statistics, horticulture crops (plantation, spice, flowers are also included) are spread over an area of about 12.93 lakh hectares with an annual production of 97.91 lakh tonnes.

Besides, hardly one per cent of the fruit and vegetable output is being processed, and between 30 and 40 per cent of the produce goes waste owing to the lack of scientific marketing facilities.

From a global perspective, India is second only to Brazil in fruit production, and to China in vegetables. However, its share in world trade (where fruit and vegetable exports rose from $1.4 billion in 1970 to $30 billion in 1990) declined from a bare 1.2 per cent in 1970 to 0.9 per cent in 1990.

Vidarbha to Have 2 Fruit Processing Units

The Maharashtra Government is setting up two multi-fruit processing units at a cost of Rs. 17 crores at Morshi near Amravati and Katol in Nagpur district to tap the huge export market for processed fruits.

The move to set up the units in the Vidarbha region is in response to a long-standing demand from farmers in this orange- growing belt. They have been demanding that the State Government provide facilities to process the fruits that are wasted every year.

According to the sources, a separate subsidiary company will be formed by the Maharashtra Agro Industries Development Corporation (MAIDC), with 50 per cent of the equity with the State Government and 50 per cent raised from financial institutions.

The processing units will initially manufacture juices, pulps and purees from orange, mango, papaya, guava and tomatoes and have an installed capacity to crush 8-10 tonnes of fruits per hour. The project will, in the second phase, take up processing of fruits such as banana and apples, it is learnt.

The new units are mainly being set up to cater to the export market in Europe and West Asia and will manufacture mango, papaya and guava products for export. The processed orange and tomato products, however, will be meant exclusively for the domestic market and in all probability be an extension of MAIDC's NOGA- brand of processed foods.

The units have been provided with sterilizing and blast freezing equipment and have facilities to store 500 tonnes of frozen food. While aseptic packaging is significantly more expensive than conventional packaging, the State Government has opted for it due to the technology being the most acceptable all over the world and the operational costs being lower than that of the conventional canning method.

The project is expected to go on stream by March 1996.

Groundnut Output Expected to Reach a New Peak

Groundnut in-shell production during the ensuing kharif harvest could reach 56 lakh tonnes, according to preliminary assessments made by some research organizations. The trade estimate of the groundnut output last kharif was 54.5 lakh tonnes, while the Government estimate was higher at 62 lakh tonnes.

The area coverage for groundnut is placed at 64 lakh hectares, marginally below last year's level. Gujarat and Andhra Pradesh, with 17 lakh ha. each, Karnataka (10 lakh ha.) and Tamil Nadu (8 lakh ha.) are the major producers of groundnut in the country.

Subject to normal weather, it is estimated that groundnut in-shell production in Andhra Pradesh and Gujarat would be 15 lakh tonnes each, Tamil Nadu about 9 lakh tonnes and Karnataka 8 lakh tonnes. Others will account for the balance 9 lakh tonnes.

Naturite Agro Products to Make Spices Powder

The Hyderabad-based Naturite Agro Products Ltd, engaged in the manufacture of spice oleoresins and spice oils, will produce spice powders, natural colours and flavours, according to company sources.

The company currently has an installed capacity to process 2,500 tonnes of spices per annum. It is now processing chillies with CFTRI technology and proposes to produce turmeric, pepper and ginger oleoresins shortly.

Campco to Export Arecanut to Gulf

Campco a multi State co-operatives company dealing in arecanut and cocoa, has entered into an agreement with the National Marketing and Trading Company Limited, Abu Dhabi for the export of arecanuts.

A release of the company said that discussions to this effect were held at the Campco headquarters recently and arrangments for the export of arecanuts were finalised. It is felt that arecanut has an excellent market in Gulf countries particularly in view of the downward trend in consumption of tobacco-based products.

It was also felt that National Marketing and Trading Company, Abu Dhabi could also explore the possibilities of entering European market.

With this agreement, the prices of arecanut is likely to rise sharply in the days ahead.

Export of arecanut in consumable forms as a whole or in pieces or in the form of chips in sachets is likely to start shortly.

India's Foodgrain Production to Touch New Heights

Foodgrain production in the country is expected to cross 190 million tonnes (mt) during the 1994-95 season. This is despite a decline in the area under foodgrains cultivation, says the Chairman of the Commission for Agricultural Cost and Prices, Dr S S Acharya.

Even though the area under foodgrain cultivation has declined by 0.32 per cent per annum between 1980-81 and 1993-94, as compared with an 0.38 per cent increase between 1967-68 and 1980-81, the yield growth has been quite high according to Dr Acharya.

As compared with a yield growth of 1.35 per cent per annum between 1980-81 and 1993-94, the percentage growth since then has shot up to 2.69 per cent for foodgrains, he said adding that the growth rate for the two periods stood at 0.94 per cent and 1.90 per cent, respectively, for the non-food grains sector.

Dr. Acharya said that the off take from the public distribution system has increased over the last two months and would be at least 14 mt during the current year as compared with 18 mt during 1992-93.

Dr. Acharya said that there is a need to accelerate growth of

both foodgrains and non-food grains, to improve security and to derive gains from international trade.

According to Dr Acharya, the increase in foodgrain production would by no means be an easy task as the scope for area expansion is very limited. "This acceleration in growth would have to come primarily through further improvement in productivity of different crops", he said.

Fisheries Development Project in Karnataka

The Karnataka Government would soon undertake a Rs. 20 crore project for fisheries development in Dakshina Kannada and Uttara Kannada districts according to the Minister of State for Ports and Fisheries, Mr K. Jayaprakash Hegde.

The project would be implemented in co-ordination with the National Co-operation Development Council (NCDC) and a final decision on the project would be taken soon.

The Minister said that out of the Rs. 20 crores to be given by the NCDC, Dakshina Kannada district would get Rs. 10.5 crores while Uttara Kannada district would get Rs. 9.5 crores, and the amount would be given to fish farmers through the local co-operative units.

Stating that the fishling production in the State during 1993-94 was about 10 crore fishlings as against the State's requirement of 40 crore fishilings, the Minister added that the government had set a production target of 20 crore fishlings during 1995-96.

Noting that the present production capacity was only 20 crore fishlings, Mr. Hegde said that the production of the remaining 20 core fishlings would be entrusted to private entrepreneurs under a scheme, where the government would give the entrepreneurs as subsidy upto rupees one lakh besides offering them buyback facility.

India to Export Wheat to West Asia

India, which has decided to export wheat for the first time, is actively looking for markets in the West Asia for wheat and other foodgrains.

As part of this effort, Food Minister Ajit Singh will be holding high-level talks in Iran, covering Iran's requirements of wheat, sugar and other items as well as other areas of bilateral relations.

The Minister said that India had received inquiries for wheat from Saudi Arabia, Egypt, the United Arab Emirates and the other Gulf states. Even countries like Brazil had shown interest in buying wheat from India, he said.

Mr Singh said that the Indian Government had decided to release 2.5 million tonnes of wheat, two million tonnes of non-basmati rice and large quantities of sugar for export from the stocks held by the Food Corporation of India (FCI).

Of this, 1.7 million tonnes of rice had already been sold so far this year to countries like Bangla Desh, the Philippines, Indonesia and Sri Lanka, he said. Some 200,000 tonnes of sugar had been exported to Sri Lanka and Russia, he added.

Mr Ajit Singh said the decision to export wheat was taken in view of the comfortable buffer stocks built up by the FCI. Against the specified level of 22 million tonnes, India had stocks of 36 million tonnes.

Good Potential for Dry Cocoa Beans Exports

There is great scope for exports of dry cocoa beans from India, according to the head of the directorate of cocoa, arecanut and spices development. The quality of Indian cocoa beans is better than Malaysian beans and on par with beans from Ghana and Nigeria.

On the domestic front, reliable figures released by the processing industry indicate that the status of the 1994-95 domestic crop is not likely to be very good. Agro-climatic factors had led to anticipations of a bumper production of about 6000 tonnes. However, unprecedented heavy rainfall in the cocoa-growing areas in May last caused heavy damage, washing away the profuse flowering and facilitating the rapid spread of the black-pod disease.

The industry has accordingly scaled down its projections by 30 per cent and estimated an all India crop of around 5,000 to 5,300 tonnes. At the same time, it has not ruled out the possibility of the crop picking up from November onward. The forecast demand for last year was in the region of 7.500 tonnes.

It has also released its realistic, optimistic and pessimistic domestic demand estimates for 2000 AD, at 16,000 tonnes, 18,500 tonnes and 15,000 tonnes respectively. The

corresponding figures for 2005 AD are 25,000 tonnes, 29,000 tonnes and 23,000 tonnes, respectively.

The gap between domestic demand and supply could be only a temporary phenomenon. Production, could be increased by implementing a comprehensive strategy.

The first stage was the rejuvenation of existing cocoa plantations through irrigation, fertilizer application, rodent control, black-pod disease control, pruning and training of the cocoa plants. This would enable the yield to go up from 800 grams to about 1.5 kg per plant.

Clonal coca gardens have been established for the purpose in the high-potential states of Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Orissa and Maharashtra.

Besides, cocoa cultivation is being encouraged in non-traditional areas like Mysore. The traditional areas are the Malnad and coastal belt in Karnataka. An instance of how the non- traditional areas can have a quicker yield has been demonstrated in the pilot project jointly implemented by Cadbury India Limited and the Karnataka department of horticulture in Mysore.

For the first time, a sum of Rs. 3 crores has been allocated under the Central sector scheme in the eighth five year plan for the development of cocoa.

India has so far been only a marginal producer and is yet to make a mark for itself on the cocoa map of the world. According to the International Cocoa Organization (ICCO) figures, heading the producers' list are the African nations, mainly Cameroon, Ghana, Cote-d'Ivoire, Nigeria and Togo, with a total output of 14,18,600 tonnes in 1994-95 (14,00,800 tonnes in 1993-94).

They are followed by the North, Central and South American countries, mainly Brazil, Colombia, the Dominican Republic, Ecuador, Mexico and Venezuela, with 5,15,900 tonnes (5,50,900 tonnes). Then come the Asian and Oceanic countries, mainly Papua and New Guinea, Malaysia, Indonesia and India, with 4,65,200 tonnes (5,50.200 tonnes).

Maxworth to Open Green Harvest Stores

Maxworth Orchards (I) Limited is planning to open about 30 more Maxworth green harvest stores by March this year.

Currently, there are 15 stores in operation. The company intends to open stores in Bangalore, and about 10 each in Hyderabad and Coimbatore. The Maxworth green harvest stores sell fresh fruits and vegetables. Maxworth green harvest stores are doing well and all of them are making money, said Mr D Haldar, President, Maxworth Orchards.

Each store is selling about one tonne of produce a day, he added. Maxworth has set up an R & D facility with Israeli technology in Sriperumbudur near Madras. The company has also set up two acres of walk-in tunnel at Sriperumbudur for growing various vegetables like baby corn, baby onion, baby carrots, tomatoes and capsicum.

Maxworth Orchards has so far covered about 15,000 acres under various horticulture crops, and is currently adding about 1,200 acres under horticulture crops every month. The company expects to cover 26,000 acres under horticultural crops soon.

Maxworth Orchards is also planning to enter processed food segment. Discussions are in the initial stages with a New Zealand-based company and a British firm for technology.

Processing units would be of two types. One type of processing unit would be in the proximity of the farms and the other near the final marketing centres.

Export Demand for AP Chilli Hotting Up

Chilli prices have touched the Rs. 5,500 per quintal mark in the Guntur market yard, the biggest in Andhra Pradesh. Trade observers say that, with a little support from the domestic market, the prices may even touch the Rs. 6,000 mark. For the past four to five months, export market - especially Bangla Desh - has been sustaining the high prices. During this period, there has been very little domestic demand.

The outlook for the trade in the near future seems quite promising, with Sri Lanka also entering the market this month. The Sri Lanka Government agency - CWB - has opened a tender on November 15 last for the import of 100 tonnes, with the stipulation that the bidder would have to supply also the excess quantity, if required.

Pakistan too imports chillies from India, but not through the direct route. The chillies are sent to Dubai and re-exported from there. It is estimated that these indirect exports may amount to over 15,000 tonnes this year. "Direct exports will be mutually beneficial. But the Pakistan

Government is not willing to allow it, according to an exporter.

According to a newsletter published by the All-India Spices Exporters' Forum, the target for chilli exports during 1995-96 has been fixed by the Spices Board at 30,000 tonnes valued at Rs. 83 crores and already, during the April-September period, 25,000 tonnes of chillies, valued at Rs. 81 crores, had been exported against only 6,629 tonnes valued at Rs. 17 crores during the corresponding period last year.

Keltron Launches Food Waste Disposer

The public sector Kerala State Electronics Development Corporation Limited (Keltron) has introduced an innovative product food waste disposer for effective disposal of kitchen / food waste. The fully imported device from the USA, being marketed by Keltron, can conveniently be fitted to the kitchen sink. The equipment is capable of disposing all kinds of waste, including meat bones, fish heads, egg shells, vegetable scraps etc.

The waste is shredded and pulped into tiny pieces which is then washed away into the drain pipe, ensuring a hygienic environment. The problem of stink and flies can also be avoided with the installation of the new device. The disposer is priced at Rs. 8,000.

Tea Packaging: Tough Going for Small Firms

With almost 85 per cent of the packaged tea market being controlled by Brooke Bond Lipton India Ltd. (BBIL) and Tata Tea, smaller players are either cutting their packaging and branding exercises, or staying small.

Industry sources say the Tea Marketing Control Order (TMCO) stipulates that 75 per cent of the tea manufactured should be auctioned, but if the company has a packaging unit, a larger quantity can be sold in the retail market.

When the auction price drops, as it did the previous year, when the CIS countries pulled out of the auction, manufacturers can sell their tea in the retail market. These will allow them to "juggle around a bit", says an industry source.

Packaged teas such as Kotada Bearer brand and Chamraj from the Amalgamation gardens in the Nilgiris and A. V. Thomas's Sutton tea have been around for some time now. They are available in big department stores and have a select following. However, retailers in the city say that Brooke Bond Lipton's Green Label, Yellow Label and Red Label brands are more popular than those from the small companies mainly because of cuppage and availability. These are also expensive and cost between Rs. 65 and Rs. 85 per half kg.

Distribution, too, plays an important part, BBLIL and Tata have a greater penetration in retail markets in the metros and towns with less than one lakh population. Smaller players have found it difficult to build wide distribution networks.

Parry Agro's foray into the packaged tea segment is, however small. The packaged tea division operates as a separate profit centre. The tea for packaging is purchased from the auctions.

The company's gardens are in Kerala, Tamil Nadu and Assam. It packages around 400 tonnes of tea a month, relatively a minuscule portion of the market. The tea is available in select outlets in the four southern States and in Maharashtra.

Gremach Tea and Estates Ltd. and NEPC Agro are relatively new entrants. Gremach Tea owns estates in the Nilgiris and Kerala, with two "bought leaf" factories in the Nilgiris.

The blending unit is in Coimbatore and the tea is called Gee Tee Dust, Gee Tee Gold and Gremach Gold. According to Gremach, the packaging unit is in the nascent stage.

Johnson Wax-Hind Lever Tie-up for Insecticides

S C Johnson & Son of the US, better known as Johnson Wax, Hindustan Lever Ltd is all set to enter the Indian household insecticides market.

HLL has also been scouting around for a partner to enter the insect-repellents market that promises to grow enough to accommodate new entrants. The company was vying to take over Transelektra with other transnationals like Bayer and Reckitt & Colman.

Shortfall in Cocoa Likely

A shortfall of 2,300 tonnes in cocoa production against an expected requirement of 7.500 tonnes is expected, as revealed at

the First National Seminar on Cocoa Development in Bangalore.

Karnataka Cocoa being less enumerative than other crops like rubber arecanut, and cashew, the farmers look for guarantees from the buyers.

The consensus that emerged at the seminar was to increase productivity by making the crop attractive and remunerative to farmers.

Increased productivity would help meet the demand for cocoa, which is growing at an estimated rate of 15 per cent per year due to the increasing number of chocolate manufacturers entering the market.

Recently, an association of cocoa user companies was formed as part of the Indian Confectionery Manufacturers Association. The main players in the industry Cadbury, Nestle, and Campco are members of the association.

Gits Food to Expand

Two dairy units of Gits Food Products (India) began trial production from the first week of November of their dairy products last year.

The Rs. 6 crore composite dairy plant is a backward integration for Gits, who have so far been manufacturers of dry instant food products. Gits will be setting up two companies. Convenience Foods Pvt Ltd and Clover Foods Pvt Ltd. The former will deal with liquid milk, butter and ghee, while the fatter will go in for milk solids including milk powder and milk caseinates which is a raw material for industries like pharmaceutical, animal and cattle feed and as an additive to instant foods. The two companies will be set up at village, Nandur, about 35 kms from Pune, in an area declared backward. They will each have capacities of handling upto 10,000 litres a day or 500 metric tonnes milk solids per annum.

With the in-house manufacture of casein, the company would explore the possibility of making Bengali sweets, too.

Gits, a family held company could go public in the coming financial year.

Satnam Overseas to Diversify

Satnam Overseas Ltd, exporters of basmati rice, is to diversify into packaged foods and food products.

The company recently launched 'Rice-N-Spice,' a ready-to-cook mixture of basmati rice, vegetables and selected spices. Besides, it has also entered into the field of mushroom exports and has tied up with Haegens B. V. of Holland for setting up a high technology plant on the outskirts of Delhi to produce mushrooms.

The company has projected a turnover of Rs. 225 crores during 1995-96.

From Salt to Sugar

Tata Tea Ltd will soon be entering the branded sugar market. The company has decided to brand its sugar "Sweet Home". The product will be double refined and is likely to be slotted as a plain sugar.

The launch is scheduled for next month. It is believed that Tata Tea will be the first company to enter the branded sugar market.

At this moment, the company official refused to comment on the product's pricing, packaging strategy and funding source.

Like the salt which was by and large a faceless thing till 'Tata Salt' was launched nearly a decade ago, Sweet Home too is expected to redefine the product and its market. The Tata assurance of quality, correct weightage and convenience would provide a clear edge over the commodity segment.

Of late, many commodities have been branded and sold in India. Salt, basmati rice, atta, pickles, masalas and papad, for instance. Branding of foodgrains have happened only recently due to the Government's decision of not allowing private enterprise in this field.

For many years, the Government, through its elaborate procurement and public distribution system, has controlled most of the country's farm produce. Things have changed with the Government recognizing the efficiency of free markets and with this, branding is activated.

Many brands in the foodgrain commodity sector which have had difficulty in selling their brands as aspirational products take better to branding than do functional ones and manufactured products more than agricultural ones.

Industry sources said some of the likely commodities where branding is slated to happen or are actually happening are fruits, vegetables, chicken, eggs, LPG and kerosene.

These are the areas the observers feel the consumer will be willing to pay more, if assured of quality.

Chilli Paste Project by Pepsi Foods

Pepsi Foods Limited is on the way to injecting red hot chilli in paste form into the world food processing market. It is executing a Rs. 60 million project in Punjab for wet-grinding "the Indian mirchi". Scheduled to be commissioned by June 1996, the project would be profitable right from the first year of operations.

Mr Abhriram Seth, Executive Director - exports of Pepsi Foods Limited - told that thereby, "India will become the first processor of aseptically packaged chilli paste for exports'.

The plant, at Zahura in Hoshiarpur district of Punjab, will have a capacity of four tonnes an hour and will be equipped with the world's most advanced wet grinding equipment, Mr Seth said, adding that there was a major market opportunity for ready-to-use chilli paste in the processed food segment.

Claiming that Pepsi was the first in the world to enter the chilli paste business of this magnitude, Mr Seth said, "Initially, we would focus on South Asia and later enlarge our market to Europe and the United States based on client specific approach. With blending, we can cater to any demand."

Based on the success of the Zahura plant, further investment could be induced, the Pepsi executive said, adding, "We expect the volume of chilli processing to equal our achievement in tomatoes (10,000 tonnes now) within three years".

For this, the Indian subsidiary of the US multinational Pepsico Inc. would procure about 30 per cent of the chilli crop in Punjab through both contract farming and by establishing backward linkages apart from open market procurement.

Expansion work at the farm level had already begun for giving commercial processing skills, and world-class equipment is slated to be installed by March this year.

NRIs Mammoth Investment in Agro Industries

Union Agriculture Minister Balram Jakhar said that Rs 3,500 crore worth foreign investment was being made by non-resident Indians and foreigners in agro-based industries in the country under the liberalized policy.

Mr Jakhar said that the Centre has signed 2869 agreements in this regard with an outlay of Rs. 7500 crore investment from NRIs and Rs. 2500 crores from foreigners.

More Rural Demand for Consumer Items

Rural India's hunger for consumer goods, spurred by rising incomes and changing tastes, is on the rise, according to a survey by a leading independent think-tank.

There is a continuation of a boom in rural demand for consumer goods, "I. Natarajan, chief economist at the National Council of Applied Economic Research (NCAER) said.

"There has been a steady improvement in the distribution of income in favour of the rural population though the growth rate has been slower in the past two years," said NCAER chief S. L. Rao.

"Earlier, the companies paid little attention to the rural consumers", Natarajan said, adding that rural customers had to come to urban centres to buy consumer items.

MPEDA's Help Sought to Market Indian Crab

The Marine Products Export Development Authority (MPEDA) should explore marketing facilities for Indian crabs to promote crab culture, said Dr D. E. Babu, Andhra University, Visakhapatnam. Speaking at a seminar on the scopes for crab farming in India, he said that India had a vast coastline and about 1.2 million hectares of land suitable for brackishwater aquaculture. Sustainable aquaculture depended upon the development of technology and adaptation of this for more than one species. Lobsters and crabs were commercially important but proper technology has yet to be developed for lobsters, he said. However, technology has been developed for crabs, but it has not been implemented properly for several reasons.

India as Leading Player in Meat Exports

After conquest of major cattle diseases, India, the world's

richest country in livestock, can well emerge as a leading player in meat exports, if suitable strategies are adopted to inject a sense of dynamism into its marketing, say exporters and scientists.

The country achieved a 34 per cent growth rate in the export of livestock products in just five years to reach Rs. 1,672 crores in 1994-95 from Rs. 792 crores in 1988-89.

The department of animal husbandry and dairying has given a major thrust to the control of animal diseases by giving assistance to States through a centrally sponsored scheme.

With eradication of cattle diseases, upgradation of technology and aggressive marketing strategies, the country can fully realise its potential of becoming a leading player in the export of meat and other livestock products.

There has been a tremendous growth in the country's livestock wealth since independence. The livestock population has shown an increase of nearly 50 per cent since 1951. There are now an estimated 200 million cattle, 77 million buffaloes, 110 million goats, 1.5 million camels, 0.8 million horses and 275 million chicken in India.

The milk production is second only to the US. With an output of 70 million metric tonnes, the production is poised to reach 100 million by 2005 A.D., surpassing the United States, say scientists.

Tag for Soft Drinks

All soft drinks and ready-to-serve beverages in returnable bottles are now required to carry the sale price declaration on the bottle or on the crown cap.

A decision to this effect has been taken by the ministry of civil supplies, public distribution and consumer affairs in consultation with the manufacturers, other government agencies and consumer organizations.

This has been done following a strong demand that the exemption given to items like soft drinks, ready-to-serve fruit beverages or the like sold in returnable bottles be withdrawn.

IDI to Launch Single Malt 12-year-old Scotch

International Distillers India will introduce India's first single malt twelve-year-old scotch whisky this year.

The single malt will be called 'Glen Spey' and will be along the lines of the famous Glenfiddich brand.

IDI will launch the product first in India, which will form part of their international portfolio.

In India, the product will compete with the two existing twelve- year-olds in the market, Teacher's Twelve year Olds and Black & White.

Both the available whiskies are, however, blended ones and not single malts.

Oyster Imports to Japan for Raw Consumption

Japan's Health and Welfare Ministry is expected to soon open the door to import of oysters for fresh consumption, a Ministry official said. "Oysters for fresh consumption will be imported as soon as the seas in which oysters are raised prove up to Japanese food safety law standards," the official said. "Information needed for imports is currently being exchanged," he added.

He did not give a concrete time schedule as to when the import ban would be lifted. The Ministry's moves are in response to official US, Australia and New Zealand requests received about two years ago.

Japan allows imports of fresh oysters on condition that they are heat processed before being eaten. Most imported oysters are from South Korea, which sends 5,000 to 6,000 tonnes a year to Japan.

Oysters for raw consumption have been banned as a result of strict regulations requiring proof that the waters in which the oysters grow meet Japanese hygiene standards. Industry officials said that they expected imported oysters to gradually take market share in Japan.

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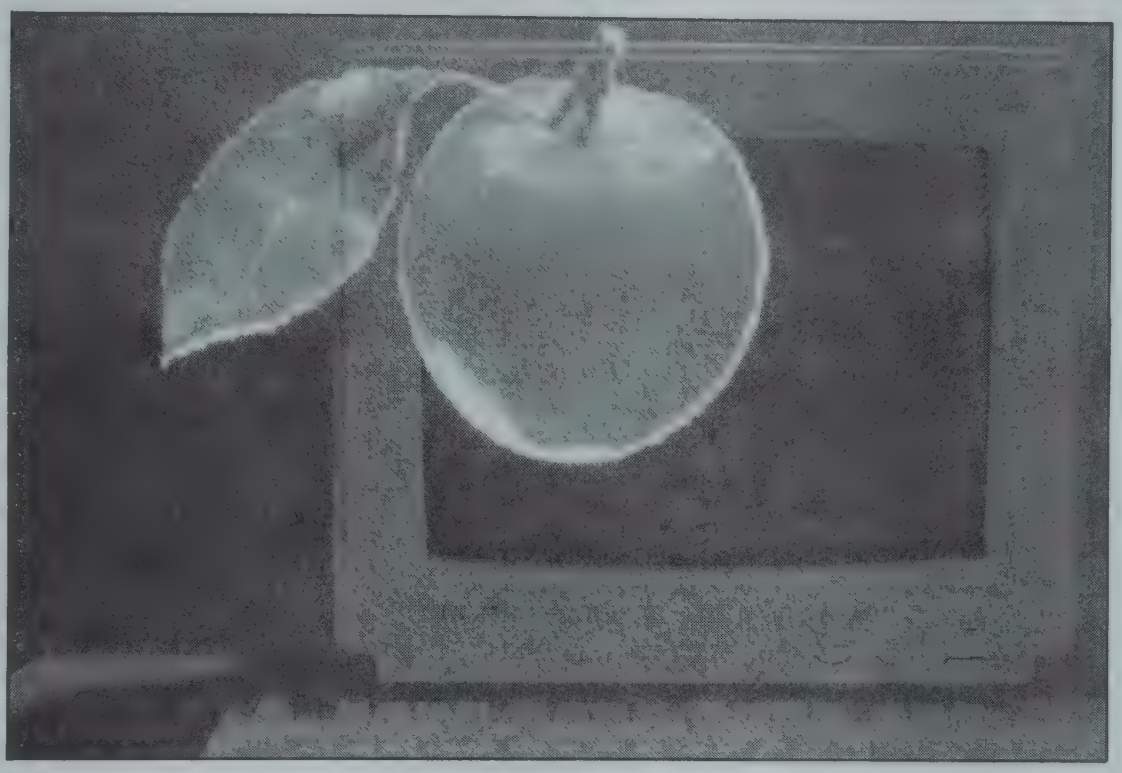

Application of Electronics and Computers for Small Scale Food Processing Industry

Impact of Environmental Pollutants, Contaminants and Adulterants in Ensuring Food Safety

Discrete Pulse Energy Input for Efficient Energy Application in Various Food Industry Operations

Gamma-Glutamyl-Transpeptidase (GGTP) - A New Indicator for Pasteurization

Application of Electronics and Computers for Small Scale Food Processing Industry

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and
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Food processing industry has taken advantage of mechanization technologies, but it still offers virtually a virgin territory for electronics and computer software applications. In consultation with a veteran food technologist involved with CFTRI and CSIR, and in the light of advances in micro-processors, a vision is presented in this paper on opportunities in fruit and other agro-product processing technologies for software developers and entrepreneurs along lines of "small is beautiful".

Background

An innovative project to create viable leather industries in villages, in a decentralised manner, has shown that appropriate de-scaling with networking of production functions at different levels of aggregation, is a viable alternative to the extant, capital-intensive, large-scale and single-unit structure of industry. This model thus marks a conceptual breakthrough in the field of "appropriate technology", till now associated with "small is beautiful" models, which have not convincingly shown their ability to survive in the economy and compete with organized industry.

A CTD project funded by the Ministry of Science & Technology, has demonstrated a replicable field methodology for Rural Artisanal Leather Industry in Mandi (Himachal Pradesh) and elsewhere, in what is now called the "Leather Model". Since 1986, such units have been self-supporting and have generated incremental incomes for rural artisans working on hides and skin. Similarly, work can be undertaken to develop and demonstrate such models in the field of fruit processing, involving decentralised and geographically dispersed production of intermediates within clusters of fruit producing villages, in a manner that is not exploitative for small growers.

Food processing industry has taken advantage of mechanization technologies, but it still offers virtually a virgin territory for electronics and computer software applications.

The "Leather model" and others being developed, show the potential for S&T-based alternatives which, while promoting rural industrialization and employment generation, simultaneously allow for a restructuring of the industry as a whole for higher productivities, reduced wastage and better utilization of by- products and huge savings in transportation

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and overheads.

The model is also in tune with much contemporary thinking that modern industry should move in the direction of de-scaling rather than up-scaling. Such an approach, in the context of rural industrialization in India, would benefit from the latest developments in S&T, notably micro-electronics and biotechnology, both eminently suitable for decentralized smaller scale operations.

Work towards development of similar models/ methodologies in other sectors such as fruit, processing, pottery, agro-processing etc., are also underway. Recently, with growing complexity of some these systems, considerable attention is being paid by CTD to study and work out application of electronics in rural industrialization e.g., in indicators / sensors, process controls and microprocessor-based systems to upgrade available skills and perform operations otherwise requiring specialist personnel usually not available in rural areas.

Problem Identification

The advent of microelectronics has caused a radical change in the industrial scenario. Highly automated systems of production with "intelligent control systems" are rapidly replacing older forms of production.

Flexible manufacturing systems have made possible automated production even with small job volumes. The chemical industry has also introduced automation and intelligent systems, but have yet to popularize the batch counterpart of the flexible manufacturing systems i.e., flexible batch processing systems.

There is little doubt that such systems will gain acceptance in the coming years. In the following sub-sections, we shall first identify the nature of change that is currently affecting the global industrial scene, then examine its implications for the country and finally deal with a possible strategy to introduce such systems in India in the context outlined earlier. Such a strategy is felt to be highly beneficial not only for rural industrialization but also for industrialization as a whole in India, and can position India favourably in the coming decades.

Global scenario and the microelectronic revolution : Industry till the '60s had been dominated by the concept of economies of scale. A larger production capacity was automatically thought to assure a higher output-to-capital ratio. As the plants became bigger and bigger,

The advent of micro-electronics has caused a radical change in the industrial scenario.

certain other factors were to upset the assumption that an economy of scale would automatically be the result of scaling-up of the plant.

Economics of scale - new factors : The factors operating against such an automatic notion of economy of scale are as follows :

a) Rapid technological change, b) Unstable markets and prices and c) Unreliability of large plants

Rapid technological change introduced an instability in the calculations derived for economy of scale. If the technology for a given process changes rapidly, the output for a given capital investment will also change. As large plants have large gestation periods, the calculation based on which the economy of scale is worked out becomes irrelevant with the obsolescence of the technology involved. For a plant with a large capital investment, this has obviously very serious consequences.

Production processes in large chemical or metallurgical plants did not change rapidly in the past. Even if a process change took place in the chemical industry, modifying the process did not require a very large investment, as the equipment involved could still be used with some modifications. Metallurgical processes have been even more stable : for instance, the basic steel making process has hardly changed for more than a hundered years. In such a situation, where capital investments are not rendered obsolete, the assumptions behind economies of scale remain largely valid.

The introduction of microelectronics led to a radical change in the industrial scene. For the first time, the equipment design itself was being affected by technological change. For instance, improved controls permitted the following :

a) Lower margins on equipment design due to superior control e.g., the ability to maintain pressures, temperatures within narrow regimes meant that design margins on equipment could be reduced. b) Elimination or reduction of large intermediate storage elements (tanks, etc) leading to more compact plant designs. The intermediate storage was introduced quite often due to control a complex process rather than any necessity of the process itself. c) Reduction of material losses in the process : in steel, for instance, losses of materials came down from 20% to 5% between the '60s and '80s. d) Better utilization of energy, a costly input to the system and e) Use

of computerized design techniques resulting in cheaper and better designs.

In the continuous process industries, therefore, changes in the nature of process controls resulted in a cascading impact on all areas of the plant. These changes in technological efficiencies of plants led further to rapid obsolescence of equipment and plants. Under such conditions, when technological changes are rapid, large investments are at an obvious risk.

Unstable markets and prices have also induced conditions under which large units are at a disadvantage. If the plant capacities are large, they are more sensitive to changes in prices of either the finished product or the raw material costs. The rise in oil prices in the '70s radically changed the economics of oil-fired, coal-fired and nuclear power plants. Similarly, the fluctuation of the cost of finished products like steel in the international market adversely affected the economics of steel plants.

While a smaller plant is also affected by changes in prices, investments for a small plant can still be considered under conditions of market instabilities. However, investment decisions involving large amounts of capital are difficult till market instabilities subside. Under such conditions, the decision to put up a number of small plants with different product mixes so as to minimize risk may be preferable, even if the capital-to-output ratio is not as favourable as for a large plant.

Unreliability of large plants have been an important element in limiting economies of scale. It has been observed that larger plants are more prone to failure and outages, as they encompass very large and complex systems. A system fails at its weakest link. A large and complex system is more likely to have such unintentional weak links.

Secondly, the loss of output involved in a large plant can cause major dislocations unlike losses in a smaller plant. Even if the down time of, say, 3 small plants being equal to that of 1 large plant, the *effect* of such outages in the former set is much less than in the latter and those 3 small plants are unlikely to fail simultaneously.

While the above scenario has been discussed largely with respect to the continuous process industry, it is also applicable to the manufacturing industry, which has also changed radically in the previous decades. Numerically-controlled tools, use of large scale plant automation, and tying up of the plant production process with the design office - via CAD/CAM systems have led to technological instabilities of the kind discussed above. Further, new materials, new machining processes like use of laser trimming etc., have also led to equipment changes and product changes in addition to changes in the manufacturing process and in design automation.

Lower bounds on unit size : So far, we have discussed the limits of economies of scale and proposed a gradual scaling down of the plants from the earlier elephantine proportions. However, there is also a *a lower bound on unit size* as the costs of automation and computerized designs are high. Very small plants are thus unable to match either the quality of the products or the basic technological efficiencies realized from the micro-electronic revolution.

The minimum economically viable unit size should, therefore, be such that :

* the plant can be automated to the extent required for the products to be "competitive" in terms of quality, and

* the process is without a large amount of material wastage.

Automation technologies as they are emerging in the West, are extremely expensive. While the basic hardware costs are not large, the cost of designing the system with "embedded" electronics, the automation system costs and the software costs introduce a very large cost element.

Computer-aided design (CAD) and computer-aided manufacture (CAM) are similarly not cost-effective for very small plants as the entry-point costs of such systems are high. Therefore, the lower bound or entry-level costs of flexible manufacturing systems and batch processing systems are prohibitively expensive for very small volumes of production.

Impact of micro-electronics in Indian industry : In India, the basic engineering paradigm has been to acquire technology from abroad and, at best, adapt it. Economies of scale were sought to be built up and it was taken as axiomatic that larger plants had a more favourable capital to output ratio. In the current situation, with fluctuating international markets, Indian industry is largely restricted to the national market which is comparatively more stable. With increasing liberalization, however, it is clear that Indian industry is neither able to match the quality of products being manufactured elsewhere in highly automated factories nor able to match the prices.

Given that automation technologies as existing now are highly capital intensive by Indian standards, the ability of Indian industry to survive in open competition seems to be low. Protective measures are one way of ensuring the survival of the industry but, in the long run, it will not help in improving technological efficiency and product quality to match those available at the global level.

Indian Industry, whether public or private, has taken to a gradual acceptance of an ancil-

lary role to globally dominant enterprises. A certain level of imports has been assumed in the production process and indigenization only affected for the areas requiring low level skills. Materials, electronic chips, designs, critical components, etc., are to be imported, while other not-so-critical items are to be manufactured indigenously.

Certain metallurgical and chemical plants are going in for an automation process more in tune with global automation levels as the companies concerned are already of unit sizes, which fall within the two limits discussed above. However, for a majority of the plants in India, either continuous or manufacturing, such an option does not seem to be open.

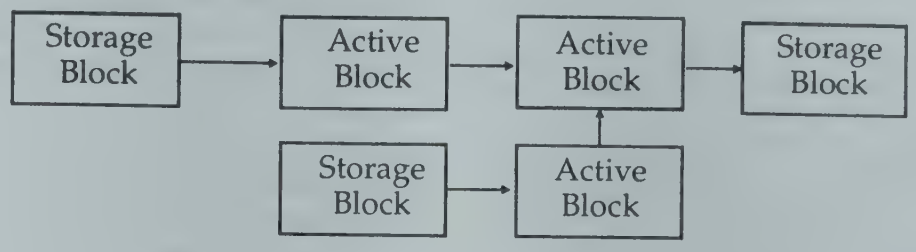
Proposed Solution : An Alternative Technological Paradigm

The option for Indian industry within the current technological paradigm would, therefore, be to either seek protection of the market or accept an ancillary level for the foreseeable future. An independent path of development, on the other hand, would have to consider an alternative technological paradigm and create tools for realizing such an alternative.

Such an alternative paradigm and the tools involved are outlined below. But first, let us consider the existing paradigm.

Existing paradigm : fixed/variable structure plants in process industry : Process industries can be considered as a complex of processes. Given a specific product or a set of products, the manufacturing cycle can be broken down into a set of constituent "active elements" and a set of "intermediate" and "final storage elements". A process plant configured as described above in block-diagrammatic form is shown below :

The active blocks above could be reactors, pumps, etc. - either transportation blocks or blocks which transform the materials flowing through it. All process plants can be described in this way - as a combination of active and storage blocks.



Fixed structure plants : In the current design of process plants, these generally have a fixed structure. For a given product or a set of products, the actual process is decided, and then the "active" and "storage" blocks are configured around the specific process with pre-defined interconnections of the various "blocks".

In a fixed-structure plant, economies of scale operate and there is a tendency to scale up the production to reach a more favourable production point. The result is that **larger plants have a clear edge over smaller ones in a given market if both have fixed structures.**

However, as discussed earlier, if there are large instabilities in the market, or rapid obsolescence of products, the large fixed-structure plants are susceptible to large losses. Under such conditions, the investment decision is based not on maximization of profit but on minimization of risk and this may preclude investment in large plants.

Variable structure plants : Hitherto-available technology did not support anything other than fixed-structure process plants. With the advent of micro-processors, however, it is possible to consider variable-structure process plants.

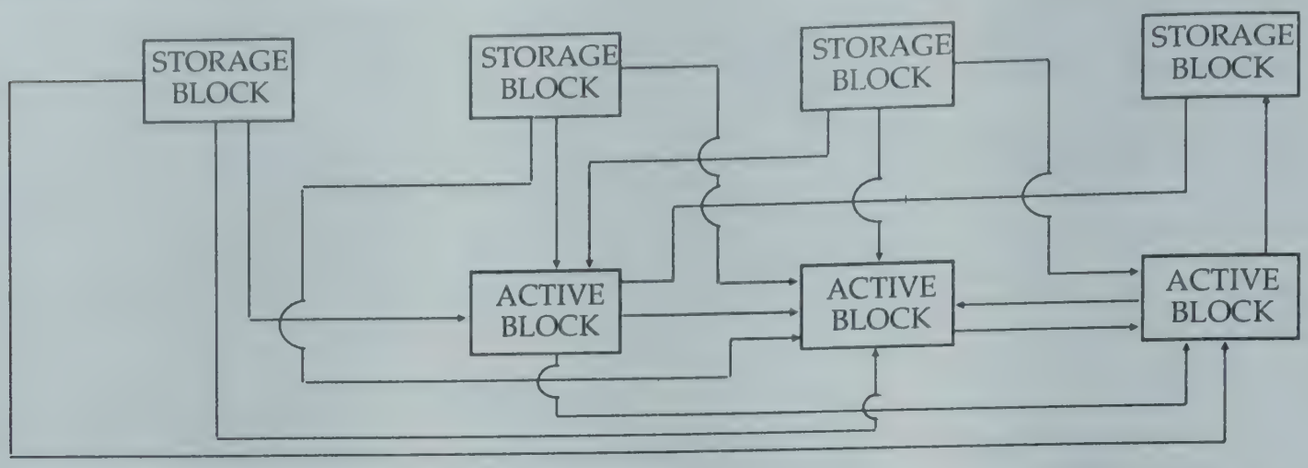
In such plants, there will be a set of active blocks capable of operating over a certain process regime. The interconnections would not be pre-defined, but would depend on the specific process decided by the set of products chosen to be manufactured. These products can then be decided, based on current market conditions. The control system would determine the sequence of processes to be followed and be capable of operating the plant within certain bounded regimes for such active blocks. The result would be a **generic process plant which can be used for manufacture of a number of products, depending on the nature of the market and the cost of the inputs.**

We have therefore, the concept of a **variable structure plant and a flexible batch processing system.**

In block diagrammatic form, such a process will be as depicted in next page at top :

Towards a new paradigm : In such systems, economies of scale are offset against the flexibility obtained by switching from one set of products to another. The market will affect the operations of the plant, but not lead to severe instabilities of operation. Above all, a new process will not render the plant obsolete.

For a country like India, in which the market is at present not large enough to have the necessary economies of scale and in which large fixed-structure plants with their attendant high



capital investments and risk factors discussed earlier, there are obvious advantages to a flexible batch-processing system and a variable plant structure.

A modular approach to plant design would permit any necessary expansion of the plant and its interconnections by adding more modules. The key to such plant design, however, is a control system which allows control regimes normally available only in large plants as well as their modification/change at short notice. Switching from one process to another requires flexibility of the control system and its easy "reconfiguration" or "reprogramming".

A flexible batch system with low-cost "software-intensive" automation devices may provide the basis for an alternative technological paradigm.

It is clear that a mere replica of the plants in the West will result in accelerated technological dependence. The dominant technological paradigm makes it difficult for efficient production at low volumes in terms of both costs and quality. A flexible batch system with low-cost "software-intensive" automation devices may provide the basis for an alternative technological paradigm.

In such a scenario, the low volumes are offset by the variety of products and the quality maintained by an extremely good control system. The software systems would allow the change of control structures at short notice so that the product mix can be changed easily. In the long run, the smaller units can be standardized more easily and the unit cost reduced due to such standardization.

Flexible manufacturing systems (FMS) : These systems are already well known in the machine industry. The "marriage" of Computer Aided Design (CAD) with numerical machine tools permits the design and production process to be tightly coupled. Low volume production can then be profitably undertaken as extensive tooling and design investments are not the pre-requisites for starting the production of a new product. In the future scenario, it has been suggested that people could walk into an automobile showroom, choose custom built parts on a computer screen and have this merged into the production schedule without any effort. In effect, custom-built cars would be no different from mass- produced ones in terms of costs and effort as far as automobile manufacture is concerned.

Flexible manufacturing systems, therefore, lead to a tight coupling of the computerized design and production control systems to the machine shops. However, the investment in such a set up is quite high. While a company like Nissan can invest billions of dollars in product design with such automation, even the more humble production units are high investment propositions by Indian standards.

Design automation and automated machining are necessary to meet the quality of products required by today's industry.

Design automation and automated machining are necessary to meet the quality of products required by today's industry. However, the investments / costs are large and can only be justified by large markets which are not available in India except for a very few products. The result is a grow-

ing dependence of Indian industry on multinationals to provide the necessary tools and the more critical components.

Again the basic issue is how to ensure a certain quality of product at the low volumes necessary. Automation of the entire manufacturing process and the use of such tools are prohibitively expensive at these low volumes. Therefore, **a new technological paradigm is required here also.**

Food Processing line with flexible elements : In order to operate in low-volume markets, it is necessary to be able to switch products. For switching production lines, the automation of the entire production line as is done in flexible manufacturing systems, is too expensive a proposition.

It is proposed, as an alternative, to introduce a few **flexible production elements** in the production line such that the requisite quality of the product can be maintained. In other words, CAD/CAM concepts are to be introduced at a few crucial points in the production line, while the rest of the production line uses more conventional machining/processing. This will allow the product quality to be competitive without increasing the cost of production drastically.

The flexible production element has to be designed carefully with the following in mind :

a) It must be capable of performing a variety of processes. b) It must be possible to "program" it from the design drawings. c) The tolerances/products must be comparable to the best in the world and d) The range of products must be large to compensate for low volumes of each individual product.

Obviously, we are talking here of appropriate technology. But this appropriateness is derived from the most advanced technologies, rather than from second-hand, hand-me-down technologies which are being peddled in the "third-world" by more advanced nations and MNC's.

We now outline the automation tools which can be used for flexible automation systems.

Tool for flexible automation systems : The major elements of a flexible automation systems are :

a) Variable-structure plant which allows change or product mix by changing process flows.

b) Variable Production Elements which allow production of different types of products from one set of machines. The introduction of variable production elements will assist the building of variable structure plants by interposing them in conventional processes also.

c) Low-cost Automation Tools which will make it possible to realize different control strategies depending on the current batch of the product mix.

d) Low-cost Computerized Design Techniques which will permit rigorous design to meet the quality requirement even for small plants.

The major elements required to be developed for the envisaged flexible production systems for small volumes are :

*** low-cost automation tools** which can be handled by a relatively unsophisticated plant operator, and

*** low-cost design tools** which can be used to "create" such flexible production plants and "modify" them for new processes.

Here, the modification really means altering the process flows and checking material specs automatically to see that they match the new process requirements.

Obviously, the major vehicle for the introduction of low-cost automation and design tools is the IBM-compatible PC. This is the cheapest and most widely used computer tool and must be the basis for any such automation attempt.

The system architecture is well known, external interfaces are easily available, and the system can be easily maintained. We are proposing to modify the system only marginally by adding physical interfaces to the plants using analog-to-digital convertors and contact inputs/outputs. Even these are readily available for the PC market.

Similarly, for the design of the variable-plant structure, low-cost design tools are readily available for the IBM-PC which can be suitably modified. As the design tools are not required at the level of single plants, but only at "Design Centres" catering to numerous units, even more expensive tools at this level can be considered.

These aspects are elaborated in the following sections.

PC-Based Automation Tools : Features Required

The PC-based automation tools, if they are to be used in the way we are suggesting, must have the following features :

a) A completely non-programming approach for configuration of "software" : automation tasks/reports, human-machine interface must be created without any **programming knowledge.**

b) Total flexibility of the system for introducing new control strategies corresponding to the current product mix.

c) Handling of closed-loop and open-loop controls. Closed loop controls are important in chemical and metallurgical processes, while open loop controls are central to machine shops and manufacturing systems.

d) Easy graphical displays to monitor the process and report- generation.

e) Modularity of design so

that the system can be expanded to accommodate plant growth and plant interconnection.

The use of IBM/Compatible PC for monitoring, controls and automation is already current. However, the software already developed does not permit the desired flexibility and ease of configuration, since they have been developed essentially for fixed structure plants. In such plants, the configuration and software development are done once at the plant level by a team of people who are already familiar with the software.

The other purely technical problem of using the IBM-PC is that it is not readily amenable to use in a real-time environment. The MS-DOS operating system has serious limitations in this regard. However, MODULA 2 -- an object-oriented language with strong real-time features -- is now available for IBM-PCs and this can be used to overcome the limitations of MS-DOS.

The major element of using a non-programming based automation software is to make it totally menu driven using normal language commands and interactive graphic language commands.

This can be realized by using a data base and a set of tools which operate on the data base. We give below the architecture and the key elements of the proposed automation software.

Proposed Automation Software : Architecture and Key Elements

1) *Real-time environment :* The real time environment will consist of a set of time slots for fixed-time based operations in the background with a set of foreground tasks for handling operator interaction, printing and archiving. The background time based slots will be set up in scheduling the various tasks.

The major element of using a non-programming based automation software is to make it totally menu driven using normal language commands and interactive graphic language commands.

The configuration of time slots and priority will be done through menu-driven screens.

All the screens will be menu driven. The menus will be pop- up/pull-down menus and will have all the requisite prompts so that the user need not memorize commands or consult manuals.

2) *Data-base :* The data base architecture will be relational. A simple structure will be built for speed of access. The data base architecture is required for the tools which will interact on the data base only.

Existing software packages for piping and P&IDS like CADPIPE, AUTOPIPE etc., can be used with some additional software to perform the basic design tasks.

3) *Design tools*: The control tasks and their definition for automation have been dealt with in the last section. However, the creation of variable structure plants poses formidable design problems which cannot be solved manually. The major design tasks for batch processes and manufacturing processes are rather different. Therefore, we will deal with them separately.

Flexible batch processes have the following characteristics:

a) A complex process topology is required in order to permit switching of products requiring completely different process flows.

b) For switching a process, materials of the piping, valves, etc. will have to be checked. For a complex configuration of the process, manual checks may pose serious hazards and may damage the equipment.

c) Process flows and design calculation have to be done every time, a process switch is made to a new process.

The above, however, have an advantage. Unlike the automation tasks, they can be carried out at design centres and without real-time constraints.

It is not necessary to develop new design tools at this stage. Existing software packages for piping and P&IDS like CADPIPE, AUTOPIPE etc., can be used with some additional software to perform the basic design tasks. The design centres can be equipped with such tools to enable batch changes to be examined. These tools may require to be tied up with good optimization software to determine suitability of the product mix.

Manufacturing systems require different types of tools for carrying out flexible manufacturing tasks. The variable process elements discussed earlier have to be tied in with good 3D-modelling tools to define the geometry of the product.

Obviously, the software design tools have to be tied up with the development of the production tool which permits quality low volume production of a variety of products.

There are two differentlevels of design problems here.

One level pertains to the development of design tools for developing the **flexible production element.** Obviously, this is a complex piece of machinery with its embedded automation software which allows a variety of production tasks to be performed. The design tools, therefore, need to be complex to develop such an equipment.

The second level pertains to the design tools required to develop the products which will be machined by these variable production elements.

The complex nature of design tasks involved to develop the variable production element preclude their detailed discussion here. The salient features are :

a) Ability to model complex mechanical elements, and simulate their movements in all the three axes.

b) Finite element analysis of such mechanical elements.

c) The ability to simulate the machining process in order to "see" the various machining processes.

Again, the tools at this level are available, even though, they are extremely expensive. However, they are required only to develop the basic tools of variable structure plants which can then be used in a number of establishments.

The second level of design tool is to be build a 3-D model and to transfer this as "software" to the variable production tool for its production. This will permit the production of high quality machined surfaces/products even in low volumes. It may be noted that, in any product, accurate dimensional tolerances are required for only a few items or surfaces.

It may be noted that the products to be developed are software products which are expected to be marketable in their own right as extremely useful products.

The rest of the production process can, therefore, remain conventional with the introduction of these tools at only a few selected points within the process.

Again, the vehicle for developing 3-D model to be translated to the manufacturing tool has to be the IBM-PC for reasons already discussed earlier. Either the design centres can have the IBM- PC, wherein the necessary 3-D models are built and then transferred as necessary "software" to the production line or they can be available at the production level where the necessary modelling is carried out. The current available software for CAD / CAM does not permit their ready use at the production level, since this demands a fairly high level of knowledge to develop the 3-D models and transfer them as software.

Initially, one can use available CAD software and modify the CAM portion to meet the requirements of the variable production element. However, in the long run CAD tools, which can be used at the production level with menu driven screens and graphic language tools will have to be developed.

It may be noted that the products to be developed are software products which are expected to be marketable in their own right as extremely useful

Software and hardware tasks

The major software requirements are

a)	Control and human machine software	(D)
b)	Piping & pid-cad software	(B)
c)	Flow-analysis software	(D)
d)	Optimization software to determine product mix	(D)
e)	CAD software for design of flexible production element 3-D modelling animation and analysis software - vax based	(B)
f)	CAD software for 3-D models and finite element analysis - PC based	(B)
g)	CAM software for manufacturing	(B)

The items marked (B) are software which are available and can be BOUGHT during initial development time. However, some of them can be replaced by DEVELOPED (D) software products later.

products. For instance, the control and human machine interface using PCs costs at present is Rs. 0.5 lakh to 1.0 lakh for a single licensed copy today and is not as powerful as the software discussed here. It has a wide market particularly for small control systems and laboratories. Similarly, flow analysis and optimization tools have ready national and international markets.

Hardware tasks are primarily the development of the flexible manufacturing element and some I/O's for ready interfacing with the process. Even the development of one such tool would pay back in a short time the investment involved.

Organizational structure of production centres : These can be envisaged as networked from top to bottom with one national and several regional design centres, developing the design and automation tools, while the process and product design is carried out at the production level.

A Suggested Approach for Projects from Engineers and Entrepreneurs

It is necessary to validate any new paradigm before substantial investments are made. It is, therefore, essential that any project be split into manageable phases with explicit objectives in each phase to validate specific

Tools

i) Graphic tools	a) Function keys with help screen for symbols.
A) Mimics	b) Cursor movement for positioning
	c) Interactive screen dialogue
	d) Micro creation, storing & positioning as any other graphic Symbol.
	e) Ability to create a symbol/group of symbol as an "Entity" for Triggering change of colour by tag no. status change.
	f) Overlays for dynamic process data.
B) X-Y plots bar charts	a) Use HPG or lotus type interactive menu driven screen to develop. X-Y plots, bar charts etc.
	b) Change of colour on alarm limits
	c) Assignment of tags and linking with dynamic data
ii) Group displays	a) Decrease a group
	b) Generate format - columns, headers footers
	c) Assign tags and other information As per format above
iii) Logs	a) -As above-
iv) Calculation	a) Use mathcad type interactive language for calculations.
	b) Allow any fortran based package to run by suitable links with data base

The use of graphic tools and menu driven screens will eliminate the need for programming skills to be available at the production level. For changing the process connections and sequences, appropriate tools will be used to define process topology and lay down the control tasks.

parts of the overall framework or paradigm.

This section outlines the overall tasks and their phasing.

At the outset, for the low-cost automation technologies, batch processing/continuous process industries shall be considered separately from the manufacturing industries.

For the batch processing/continuous processing industries, there are two levels of tasks involved :

- to design a suitable flexible batch processing plant, capable of switching its raw materials and products based on prevailing market conditions;

- to develop a suitable control system, enabling such a plant to be controlled within close tolerances, a new control strategy whenever such switching takes place.

The design tasks for both these levels will now be outlined.

Phase 1 : In this Phase, the tasks/output are essentially two :

* conceptual design of flexible batch processing plant

* software and hardware specifications for a low-cost PC-based automation system

The design task is to evolve a conceptual design of a variable structure flexible batch processing plant. The piping topology, reactors, storage vessels, compressors, pumps, heat exchangers etc., will all be designed conceptually, keeping in mind the need for product switching.

A set of products will also be identified for such a plant. The objective here is to test the feasibility of such a plant and its cost *vis-a-vis* the flexibility built into the plant. Clearly, there are limitations to the flexibility one can build into a plant, since plant costs are an important constraint. This exercise will, however, identify the increased capital costs required to provide a multiple product mix.

With the conceptual design and the cost parameters, the plant behaviour can be simulated, based on market conditions. A decision regarding switching of various products or varying the properties of the output will be done using optimisation techniques. The simulation over time will give an idea of the benefits of flexiblity and of this overall approach. The risk factor and the relative safety margins that a flexible batch processing plant offers be analysed by simulating large disturbances in the market price of various inputs/outputs.

The risk factor and the relative safety margins that a flexible batch processing plant offers be analysed by simulating large disturbances in the market price of various inputs/outputs.

This entire exercise can be done in 1 year.

The above is a design exercise to establish the validity of a flexible batch processing industry.

Development of the low-cost automation tools can take place **in parallel** with the above within the 1st Phase itself.

Such tools are required by a sizable number of small industries who are otherwise unable to invest in the current automation technologies due to their exorbitant cost.

These low-cost automation technologies can be designed as outlined in the earlier section.

The work will be subdivided amongst research groups in such a way as to ensure that a product is available within one year.

Initially, the product will be available more along the lines of conventional packages but with the major difference that they will be far less expensive, available on the PC platform and easily configurable. However, the product should also be available for growth using networked structures.

Thus, tasks and output in Phase 1, for a typical project of this type can be envisaged as follows :

a) Develop the concept of flexible-batch and flexible manufacturing systems using low-cost automation tools.

b) Develop system components for such a concept.

c) Develop software specifications for control and automation software, optimization software and analysis software.

d) Develop a plant schematic of a variable structure plant, complete plant costs.

e) Simulate operation of such a plant over a given time period with changing product mix to maximize profitability using standard LP/MILP packages.

f) Define product specification for one variable production element.

g) Develop and make available low-cost PC-based automation tools to wider market, with scope for development and integration with flexible / batch systems in later phases.

Subsequent phases : The flexible manufacturing systems can be taken up after there has been some validation of the above paradigm. Obviously, the type of software required for such systems is quite different from that for control purposes.

Detailed development of a flexible **manufacturing** element can be done after the first phase of the flexible batch **processing** system is over.

The various tasks involved in 2nd and later Phases would be, in brief :

2nd Phase

a) Develop process plant on a pilot-plant scale

b) Develop software packages as per specifications

c) Complete design of a flexible manufacturing element

3rd Phase

a) License know-how widely as software packages to process industries, based on actual performance of pilot plant.

b) Develop prototype of a flexible manufacturing tool.

c) Set up national and regional design centres

4th Phase

a) Licence know-how based on prototype success of flexible manufacturing tool.

b) Set up national and regional design centre.

c) Develop network of design and production groups.

Conclusion

One of the authors, Shri P. Purkaystha of CTD, has his own company called Sagarika Enterprises, Delhi, which can undertake the controls and software designs and productionisation. CTD is currently with 2 CSIR laboratories viz., CEERI, Pilani (Central Electronics Engineering and Research Institute) and NISTADS (National Institute for Science, Technology and Development Studies), to work out a project proposal for funding. However, involvement of food processing industry entrepreneurs and other field-level agencies wanting to undertake field-level experimentation will make this project easily implementable and more likely to result in industry-acceptable results. Response from Indian Food Industry is solicited.

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Chief Editor
On behalf of AFST(I)

Impact of Environmental Pollutants, Contaminants and Adulterants in Ensuring Food Safety

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Introduction

Historically, a major concern of human societies has been the attainment of sufficient quantities of food to provide a healthy life to their citizens.

India is exporting fruits and vegetables-based products worth Rs. 57 crores, marine products worth Rs. 1000 crores and meat products worth Rs. 140 crores.

Only after this, the energies are devoted to progress in other areas. After the start of Green Revolution and attainment of self sufficiency in food production, the need for food processing was realized. It is estimated that 30- 35% fruits and vegetables worth of about Rs. 3000 crores perish due to want of poor post-harvest facility, thus depriving the farmer the fruits of his labour (Sethi and Maini 1989). Sodium chloride was one of the first substances to be added to food as preservative which is still a major preservative. The search for chemicals useful in preserving foods and increasing the palatability of preserved foods continues today.

Over the last few decades, both developed and developing countries experienced many life style changes that have led to an increased demand for processed foods. Processed foods now represent over 50% of the diet of many developed countries. The demand for ready-to-eat foods is increasing presumably with more and more women folk venturing the out of house work culture.

India is exporting fruits and vegetables-based products worth Rs. 57 crores, marine products worth Rs. 1000 crores and meat products worth Rs. 140 crores (confederation of Indian Food Trade and Industry, 1991). There is a considerable scope for processing the food products to increase the domestic market and boost the export potential of processed food products.

With the fast growth of food processing industry due to new liberalization policy of the Government, the use of various food additives is also increasing to meet the technological requirements.

With the fast growth of

food processing industry due to new liberalization policy of the Government, the use of various food additives is also increasing to meet the technological requirements. Coupled with this, the demand for an essentially risk- free food supply has increased. The scientific and public debates over the safety of chemical additives, contaminants, adulterants and pollutants appearing in foodstuffs have emphasized the necessity for a logical, rational and scientific approach to the regulation of these materials in the food supply. In India, different food regulation agencies such as Prevention of Food Adulteration Act (1954) and Rules thereunder, formulated by the Central Committee for Food Standards (CCFS), Directorate-General of Health Services (DGHS), provide regulations on types of additives used, standard specifications of individual commodities and limits of contaminants in foodstuffs.

The common pollutants, contaminants and adulterants, causing concern to food industry and consumers could be broadly classified as (i) intentional and (ii) non-intentional additives. The first category includes deliberate adulterants added for the purpose of disguising inferior commodities and/or earning undue profits. The second group of non-intentional contaminants can come during production, processing or packaging and storage.

The examples of some non-intentional toxic contaminants appearing in foodstuffs during production and storage include antibiotic and other agents used for prevention and control of diseases, growth promoting substances, microorganisms of toxicological significance or their toxins and parasitic organisms. Insecticides, fungicides, herbicides, solvent residues and toxic metals form the other such contaminants. Microorganisms and their toxic metabolites and residues form inferior quality aids can crop up during the food processing steps. At the packaging and storage stages, labelling and stamping materials and migrants from packaging materials together with toxic chemicals from external source are the major groups of non-intentional contaminants in foodstuffs.

This paper highlights the common sources of pollutants, contaminants and adulterants, which cause concern in offering safer food to consumers. The commonly encountered food adulterants / pollutants and their health implications are as follows :

Intentional Food Adulterants

Non-permitted Food Colours

The use of colours for making foodstuffs attractive has been known for centuries. Artificial colouring is also necessary in case of processed foods, canned and pulped fruits and vegetables, which often lose their natural colour during processing or storage. However, because of comparatively low cost, a number of non-permitted colours are frequently used and this constitutes a hazard to heat (Singh and Khanna 1992).

Light pale cheaper oils dyed with synthetic dyes are sometimes sold under the pretext of mustard oil.

Adulterants in Edible Oils

India, in recent past, has experienced huge gaps between supply and demands of edible oils. Such shortages not only put pressure on imports, but prompt the unscrupulous traders to indulge in malpractice of adulteration. Some of the toxic adulterants in edible oils are as follows :

Argemone Seed Oil

Argemone maxicana seeds bear a close superficial resemblance to black mustard seed and are not easily distinguishable. Deliberate or accidental mixing of seeds and consumption of argemone contaminated mustard oil, even at low levels for a short duration, is known to cause epidemic dropsy (pitting oedema), gastro-intestinal disorders, tension and glaucoma, breathing trouble, enlargement of heart and cardiac arrest. A comparative study for the detection of argemone oil in mustard oil has been made by Nasirulla *et al.* (1984).

Colouration of Edible Oil

Light pale cheaper oils dyed with synthetic dyes are sometimes sold under the pretext of mustard oil. The typical mustard pungency in such oils is imparted by the addition of artificial synthetic essence (allyl isothiocynate). Butter yellow, a fat- soluble synthetic non-permitted dye has been occasionally encountered and can cause serious health implications. Different concentrations of hydrochloric acid can detect the presence of coal tar soluble colour in the oil (Krishnamurthy 1993).

Tricresyl phosphate (TCP)

An odourless, colourless industrial chemical, TCP has been shown to cause polyneuritis in animals and humans, eventually leading to paralysis of hands and feet. An outbreak, through the consumption of TCP adulterated

rapeseed oil took place at Behala in South - West outskirts of Calcutta in July 1988 and adversely affected the people. During this period, several rapeseed oil samples were analysed and some of them were found to be contaminated with TCP (Krishnamurthy *et al.* 1985).

Adulterants in Cereals/Pulses

Kesari *dhal, Lathyrus sativus* and its flour are at times mixed in arhar, *Cajanus indicus* dhal and dehusked Bengalgram flour *(besan).* There is a ban on the use of *Lathyrus* in many States. Its continued consumption, in appreciable quantities over a long period, causes progressive spastic paralysis of lower limbs, commonly referred as neurolathyrism. The disease has been held responsible for crippling several thousand people (Jha 1987).

Non-Intentional Food Contaminants /Pollutants

Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons are ubiquitous environmental pollutants and have been shown to occur in water, air and sold as well as such diverse sources as tobacco smoke, automobile and engine exhausts, high boiling petroleum distillates, carbon black, coal tar pitch, rubber etc. (Ermakova and Yurchanko 1993). With the development of sensitive analytical procedures, voluminous data on the presence of polycyclic aromatic hydrocarbon in foodstuffs, have become available. The sources of such contamination include polluted air and water, modes of cooking or preparation of food additive and food processing. Among edible oils and fats, coconut, soyabean, cottonseed, sunflower oils, and margarine and mayonnaise have been found to be contaminated with polycyclic aromatic hydrocarbons. Many such hydrocarbons are potent carcinogens (Yuco *et al.* 1993 ; McGill *et al.* 1993).

Among edible oils and fats, coconut, soyabean, cottonseed, sunflower oils, and margarine and mayonnaise have been found to be contaminated with polycyclic aromatic hydrocarbons.

Toxic Metals

The rapid industrialization and use of various metals for a variety of purposes have led to release of significant quantities of metals in our environment. Some of the metals, with well recognised toxicity, have been detected in air, water and soil, in quantities higher than the permissible limits. Thus, besides the industrial workers handling various metals, the general public, animals, flora and fauna are also getting exposed to toxic metals. There are atleast twenty metals which have been found to give rise to well recognized toxic effects on man and environment. They include antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, molybdenum, nickel, and tin. Some heavy, metal residues arise during processing and from the use of animal fed additives (WHO 1987). Lead is one of the most prevalent contaminants found in food products. The major source of lead contamination in food is through air. Air- borne lead may contaminate dust, which may then blow onto food and crops (Kacew and Singhal 1980).

In India, the total use of pesticide which was 8620 tonnes in early sixties, has risen ten fold in three decades and is around 80,000 tonnes presently.

The outbreak of *itai-itai* disease in Japan following consumption of rice containing high levels of cadmium is reported by Ishizaki and Fukushima, (1968). The occurrence of *Minamata* disease after consumption of methyl mercury contaminated fish, have highlighted the risk of these environmental pollutants in food chain.

Industrial effluents, containing metals, constitute a major source of metallic pollution of hydrosphere. In polluted coastal waters, there is a great possibility of concentration of toxic elements within the food chains in the marine ecosystems. Similarly, milks of buffaloes and cows of the villages near the river had high concentration of mercury. The high contents of mercury in the soil had perhaps been transported to the plants and transferred to the cattles grazing on the river banks.

Pesticide Residues

The use of pesticides is an important contributing factor to the agricultural revolution

resulting in an increased quantity and quality of foodgrain. In India, the total use of pesticide which was 8620 tonnes in early sixties, has risen ten fold in three decades and is around 80,000 tonnes presently. Our country is the largest manufacturer as well as user of pesticides in South Asia. Organochlorines, organophosphates and carbamates are the three major classes of pesticides commonly used. Some pesticides might persist even after they have their purpose. Pesticides can occur not only in plant materials for human and animal consumption, but also in animal products and tissues. Residue monitoring has indicated widespread contamination of cereals, pulses, poultry and dairy products. The present levels of pesticides in certain foods may warrant caution and efforts need to be directed to ensure any further rise.

An important component in evaluating risks from pesticides in foods is estimating dietary exposure from pesticides. Effects of the limit of detection (LOD) on dietary exposure assessment were examined. It is important to assess the effect of LOD on exposure assessment should be evaluated before commencement of the analytical phase of survey. The purpose of evaluation is to determine LOD required to adequately quantify human exposure (Loftus *et al.* 1992).

Solvent Residues

During processing of edible oils, n-hexane and n-heptane are used as organic solvents for extraction of oil. Non-food grade solvent residues may affect the solubility of such food products for consumption. n-hexane is believed to exert its neurotoxic effect via polar metabolite, 2, 5-hexanedione (Spencer *et al.* 1978).

Plastic Residues

Di-(2-ethyl hexyl phthalate (DEHP) is commonly used as plasticizer to impart flexibility to polyvinylchloride. The presence of DEHP in 80, 71, 94 and 52% of salted meat, jam, baby food and milk samples, respectively in 200 samples of Italian packaged food products (Coachieri 1986). DEHP has been shown to exert teratogenic, mutagenic, carcinogenic and hepatotoxic effects and cause renal, pulmonary and reproductive dysfunction in aquatic invertebrates and mammalian species (Autian 1982 ; Thomas *et al.* 1982 ; Tomita *et al.* 1982).

Safety of a food is generally defined as the absence of signs of toxicity under certain prescribed conditions, whereas risk is the potential ability of the substance to produce a harmful effect.

Microbial Contamination

Food is a vehicle for the consumption of a vast array of microorganisms, including many that are either pathogenic or produce toxic metabolites. These microorganisms may originate from the soil, water, air, animals, insects, processing and packaging equipments, or from humans involved in food processing and preparation. Illness may be associated with consumption of food containing microbial toxins. Considering the potential, it is not surprising that a major source of human disease is through consumption of microbial toxin-contaminated food. The bacteria most commonly associated with foodborne illness belong to the *Staphylococcus, Clostridium* and *Salmonella* species (Murray 1993).

WHO data indicate that only a smaller number of factors are responsible for a large proportion of foodborne disease episodes everywhere. The common errors include preparation of food too far ahead of consumption or keeping prepared food for a long period at a temperature facilitating bacterial proliferation.

Moulds have provided various fungal metabolites with important medicinal uses. However, some of these also produce secondary metabolites which may lead to severe adverse human health effects. Mycotoxins represent a diverse group of species specific chemicals that can occur in a variety of plant foods. They can also occur in animal products, derived from animals consuming contaminated foods. Among the various mycotoxins, the aflatoxins have received the most intensive attention because of the extremely potent hepato-carcinogenicity and toxicity of afalotoxin B_1.

Besides the non-intentional contaminants, certain impurities may crop up from the raw materials, the processing aids, the equipments or the packaging. These could be restricted by selecting good quality raw materials and adopting good manufacturing practices.

Overall Perspectives

Safety of a food is generally defined as the absence of signs of toxicity under certain prescribed conditions, whereas risk is the potential ability of the substance to produce a harmful effect. As per estimates, the

world population will increase by more than 50% and exceed 6.6 billion by 2000 AD. About 90% of these would take place in the developing world. The large population increase has eroded the gains in food production achieved over the last 20 years and exert pressures on the availability of food, its distribution and price structure. There are also problems in post-harvest handling which not only entails high costs but results in large losses because of inadequate handling, processing and storage facilities.

Deliberate adulteration is generally encountered not only in the organized food industries, but also at the small retail outlets. In the non-intentional category of food contaminants, good quality raw materials and maintenance of absolute hygienic conditions may help in solving the problem of microbial, metal and other environmental pollutants to a great extent. The need for formulating maximum permissible standards for various contaminants in food preparations, taking into account the social, cultural, economic and nutritional status, has to be attempted on priority basis. The basic requirement of safe food for humans can be fulfilled only after ensuring good quality food, by keeping the contaminants as low as possible.

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INTERESTING FOOD FACTS

* Many people believe that live cultures in yoghurt have health- promoting properties so they avoid heat-treated or pasteurized yoghurts.

* Most lean raw meats are 70-75 per cent water.

* Current maximum allowed levels for total aflatoxins in foods vary from 0.4 to 2 mg per gram from country to country.

* Goat's milk is a relatively good source of thiamin, riboflavin, and niacin compared with cow's milk, but a poorer source of cobalamins.

* Vitamin C retention in peas frozen at -25^{0}C for 12 months is approximately 90 per cent.

* Lactose has only one-third of the sweetness value of sucrose.

- Selected -

Discrete Pulse Energy Input for Efficient Energy Application in Various Food Industry Operations

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Abstract

Discrete pulse energy input (DPEI) is a novel concept of application of energy in various physical processes of importance to the dairy and food industries. In principle, DPEI involves introduction of energy in the form of discontinuous high- intensity pulses throughout the bulk of the process fluid. The conventionally energy-intensive processes can greatly benefit from this technology by way of considerably reduced energy requirements. The specific areas of application of DPEI are processing of multi-component liquids with the aim of obtaining stable emulsions, and effecting mass transfer in a range of disperse gas-liquid systems such as aerated liquids. Treatment of water and food industry waste can also be made more efficient by adopting the DPEI concept.

Extensive research at the Institute of Thermophysics, Kiev in Ukraine has resulted in development of new emulsification and aeration devices based on the DPEI principle. Some of the applications involve only certain modifications of the conventional systems so as to make them amenable to the DPEI approach as in the case of fermenters and waste treatment ponds. Such modifications are often provided in the form of DPEI applicators designed at the Kiev institute. Certain other devices are, however, entirely newly developed as, for example, milk homogenizer.

Introduction

Processes like emulsification, homogenization, extraction and carbonation involve important unit operations with a view to effecting size reduction and mass transfer. Such hydrodynamic processes involving multi-phase disperse systems often consume considerable energy. The energy consumption is largely governed by the mode of energy application. There are two different ways of applying energy to a process fluid viz., local energy input and discrete pulse energy input (DPEI). In conventional methods using, for instance, mechanical agitators or propeller mixers, sufficiently high intensification occurs only in a very small local portion of the liquid body which lies in the immediate vicinity of the energy input zone. A large portion of the energy introduced is consumed in recycling the liquid from the passive zone to the active zone and back to the passive zone. On the other hand, with the DPEI system, energy is distributed throughout the bulk of the liquid, the energy being transferred through high-frequency, short-time pulsations at each element point in the fluid mass.

Processes like emulsification, homogenization, extraction and carbonation involve important unit operations with a view to effecting size reduction and mass transfer.

How is DPEI Achieved ?

There are several possible ways in which DPEI can be effected. The basic method entails providing vapour or gas bubbles uniformly distributed throughout

the liquid bulk. Upon changing the external pressure applied on such a disperse system, the bubbles may cause high-frequency pulsations and release acoustic energy or collapse producing shockwave and microactivation effects, or they may suddenly expand to produce inter-bubble and interfacial turbulence (Fig. 1). Such effects may come into play even at relatively long distances from individual bubbles. This makes it possible to achieve efficient power transfer to the zone around each bubble within small time intervals. This results in enhanced energy intensification throughout the system where pressure changes take place.

Thus, the system of pulsating bubbles distributed across the fluid mass can be regarded as a transformer of energy supplied from an external source such as a pump or compressor,

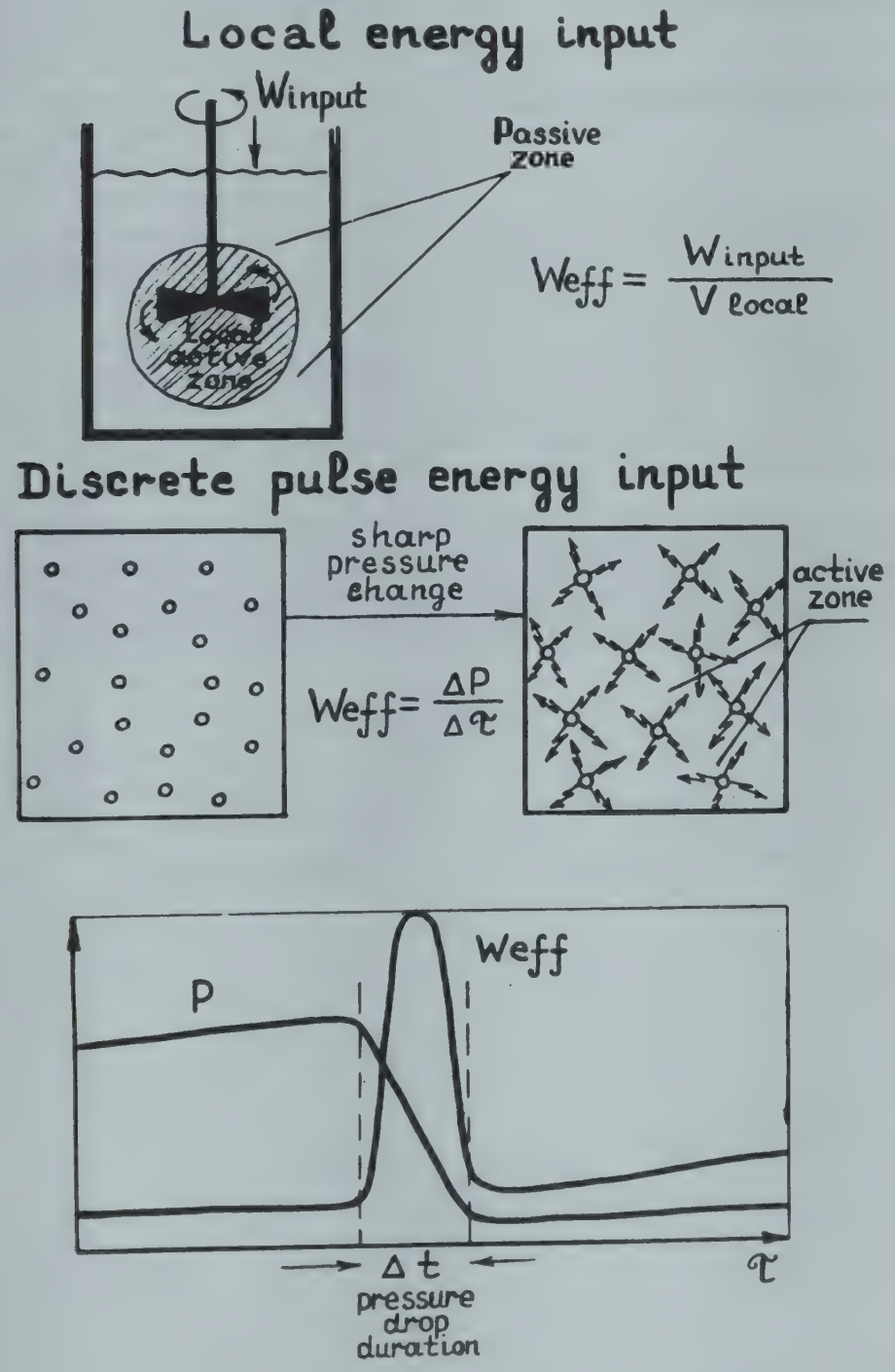


Fig. 1 The principle of Discrete Pulse Energy Input (DPEI) vis-a-vis local energy application

The mechanism of operation of the PDEI system seems to be somewhat similar to that operating in valve homogenizers used in the dairy industry.

into the energy which is discrete both in time and space. The high specific power thus released in the form of high-intensity pulses brings about the desired physical effect i.e., size reduction or mass transfer in the multiphase system.

The phenomenon of DPEI can be considered somewhat analogous in principle to laser which is known to produce a powerful, highly directional monochromatic and coherent beam of light. Accordingly, the energy is momentarily accumulated and then released in the form of a powerful short-time pulse. Thus, the interaction between energy and the medium takes place at a qualitatively new level.

The DPEI Mechanism of Drop Size Reduction

The mechanism of operation of the PDEI system seems to be somewhat similar to that operating in valve homogenizers used in the dairy industry. In the latter, fat globule break-down is considered to take place as a result of one or more of the impact, shearing, vibration, cavitation and turbulence effects (Kessler, 1981; Phipps, 1985). Theoretical analysis has shown that in a PDEI system, relative

velocities of the order of 5m/s and local acceleration of about 10^7 m/s^2 can be achieved in the vicinity of pulsating bubbles, when oscillating frequencies are high. Such conditions at the interface of oil drops or bubbles in a disperse liquid are known to break up the drops or bubbles through a wave-like excitation of the drop surface. Further, a high-level inter-bubble turbulence is believed to break up drops in a cloud of collapsing bubbles. Detailed calculations indicate that in a group of growing bubbles with the inter-bubble space being comparable with the bubble size, the energy dissipation level is comparable with that of the turbulent flows in valve homogenizers are colloid mills.

The New DPEI Devices

The DPEI concept is of particular significance in processes such as homogenization, emulsification, extraction etc., where the process efficiency depends on how much one of the phases is atomized, resulting in the largest possible interfacial area. Extensive theoretical considerations and experimental analysis of the drop disintegration mechanism in respect of the DPEI concept as applied to liquid-liquid dispersion have led to the development, at the Institute of Thermophysics, Kiev in Ukraine, of a fundamentally new class of devices not only to obtain high quality stable emulsions and homogenized mixtures, but also to bring about efficient mass transfer in fermenters and aerators.

The industrial fermenter with pressure release provision is a simple example of how the DPEI principle could be translated into a practical device.

Ultrasonic homogenizers are known for their laboratory and industrial applications. With regard to DPEI systems, every bubble pulsating in the liquid can be regarded as a high frequency acoustic microgenerator. Analysis shows that the specific power of these microgenerators exceed the capacity of commercial ultrasonic generators which are used to intensify dispersion processes as well as heat-and-mass transfer processes in disperse liquid systems. It is evident from Table 1 that gas bubbles pulsating in the liquid can, under certain conditions, successfully compete with the commercial ultrasonic generators. The major advantage that would

Table 1. Comparative acoustic field characteristics of an ultrasonic vibrator and a pulsating bubble in water (DPEI)*

Field characteristic	Ultrasonic vibrator	Pulsating bubble at dia, μ		
		10	100	1000
Liquid velocity amplitude, m/s	0.36	2.8	5.3	11.4
Liquid acceleration amplitude	7×10^5	3.8×10^6	4.5×10^5	2.3×10^5
Sound pressure amplitude, Mpa	0.56	2.5	5.0	9.5
Sound wave intensity, W/cm^2	10	6.7	2.2	70
Oscillation frequency, MHz	0.3	0.2	0.014	0.003
Specific power, W/cm^3	20	100	230	480

* Water temperature, 27^0C; gas fraction in water, 0.05; initial pressure in water, 0.2 MPa; final pressure, 0.002 MPa; pressure change interval, 10^{-3}s.

accrue from the DPEI system is reduced energy consumption.

DPEI in a Fermenter System

The industrial fermenter with pressure release provision is a simple example of how the DPEI principle could be translated into a practical device. In many fermenter processes, oxygen is supplied by bubbling air through the fermenter fluid. Conventionally, a mechanical agitator is used for intensifying the mass transfer in this case. However, a proteinaceous film forming at the bubble-liquid interface results in low mass transfer coefficients.

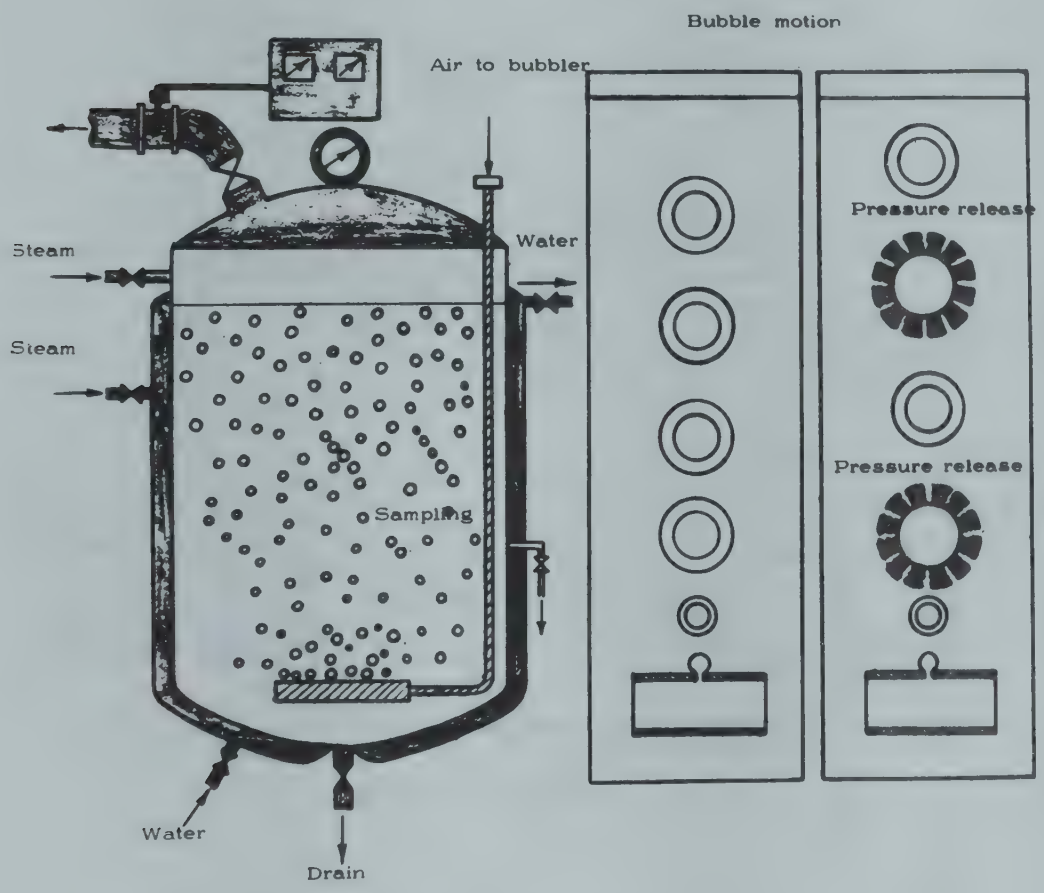
The oxygen transfer can be made more efficient by replacing the agitator with a valve provided in the fermenter's air exhaust line and abruptly releasing the air pressure in the fermenter by automatic activation of the valve upon the pressure reaching a pre-determined value (Fig. 2). The bubbles rising to the surface suddenly expand disrupting the protein film and turbulyzing the surrounding liquid. This makes it possible to accelerate mass transfer throughout the bulk of the liquid.

The DPEI mass transfer processes have a specific application in aerators and saturators such as those employed in ponds and other large bodies of water.

A modified version of the mass transfer fermenter is provided with one or more tubular pulsators, one end of which is immersed in the liquid, while the other end is alternately connected. The pulse frequency in the pulsator ranges from 5 to 100 Hz. The air bubbles forming a fine suspension in the liquid pulsate promote oxygen transfer. The use of pulsators increases the mass transfer coefficient several fold.

DPEI Aerators

The DPEI mass transfer processes have a specific application in aerators and saturators such as those employed in ponds and other large bodies of water. The so-called ADE-100 aerator (Fig. 3) can be used to saturate with oxygen a water reservoir as large as 5 ha within a very short time. This system employs a special disperser (designated as mass transfer apparatus) which consists of three perforated disks tightly fitting one another, with the middle one rotating at a high speed. By periodically shutting and opening the passage (through the disks) of compressed air into the liquid at a frequency of 1-6 kHz,



TECHNICAL DATA

Parameters	Fermenter with bubbler and impeller	Pressure release
Specific power of agitator kW. h/ m^3	1.5	0
Air flow rate, m^3 / m^3	1.5	1.5
Antifoam agent consumption, %	100	0
Mass transfer coefficient, m/s	0.72	0.96
Capacity, %	100	120

Fig. 2 DPEI principle as applied to oxygen supply in a fermenter

the disperser effects high intensity pulsations of the resulting air bubbles in the liquid. Under optimum operating conditions, the system enables to achieve the bubble resonance effect that yields very high mass transfer coefficients.

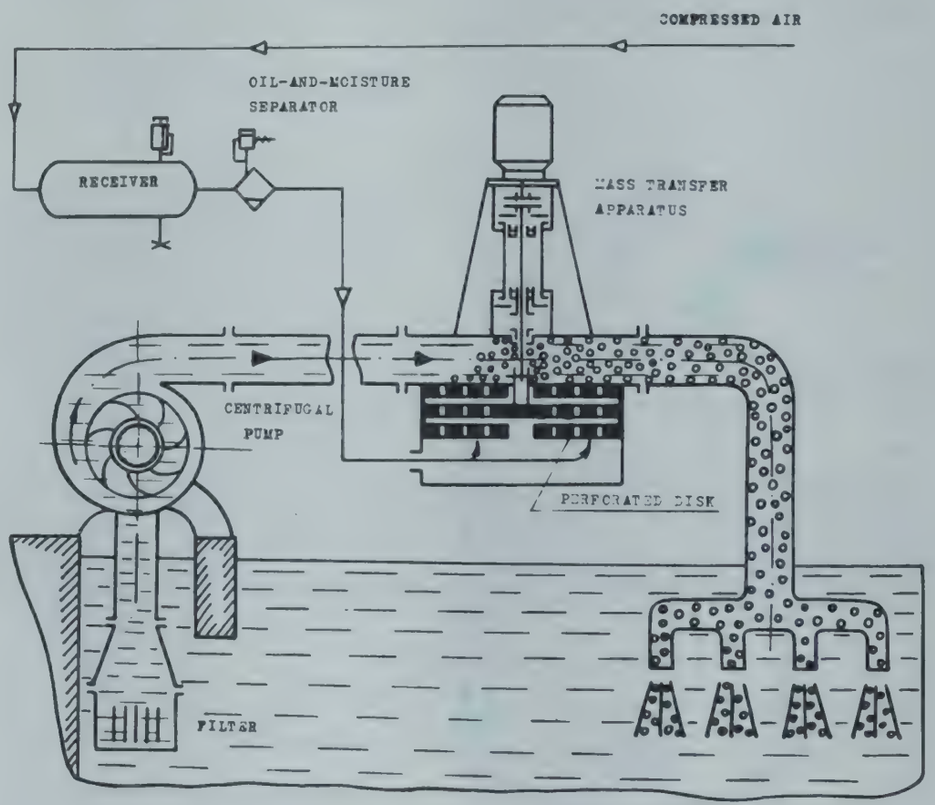
The disk-type disperser has also been incorporated into a carbonation device for wines (Fig. 4). For saturation of sparkling wines and carbonated drinks with carbon dioxide, small pulsating bubbles of the gas are supplied through the perforated disk system into the continuously flowing liquid, the pulse frequency ranging from 0.2 to 10 kHz.

The discrete pulse energy input or DPEI principle has been incorporated into various processing equipments useful for various food industry operations such as emulsification, dispersion and aeration.

Emulsifying and Homogenizing Devices

In a variation of the DPEI system, gas bubbles are produced through adiabatic boiling of a superheated liquid under reduced pressure. As shown in Fig. 5, the process intended to bring about emulsion formation involves heating of the mixture of two immiscible liquids to a temperature corresponding to superheating of the lower boiling liquid and feeding the heated mixture through a special nozzle into a vacuum chamber. The instantaneous boiling of the superheated liquid causes the formation of growing vapour bubbles through which the DPEI mechanism operates to cause emulsification of the higher boiling liquid component. Conceivably, the nozzle design, pressure at the nozzle inlet and that in the vacuum chamber are the main determinants of the degree of emulsification or droplet size reduction achieved in this device.

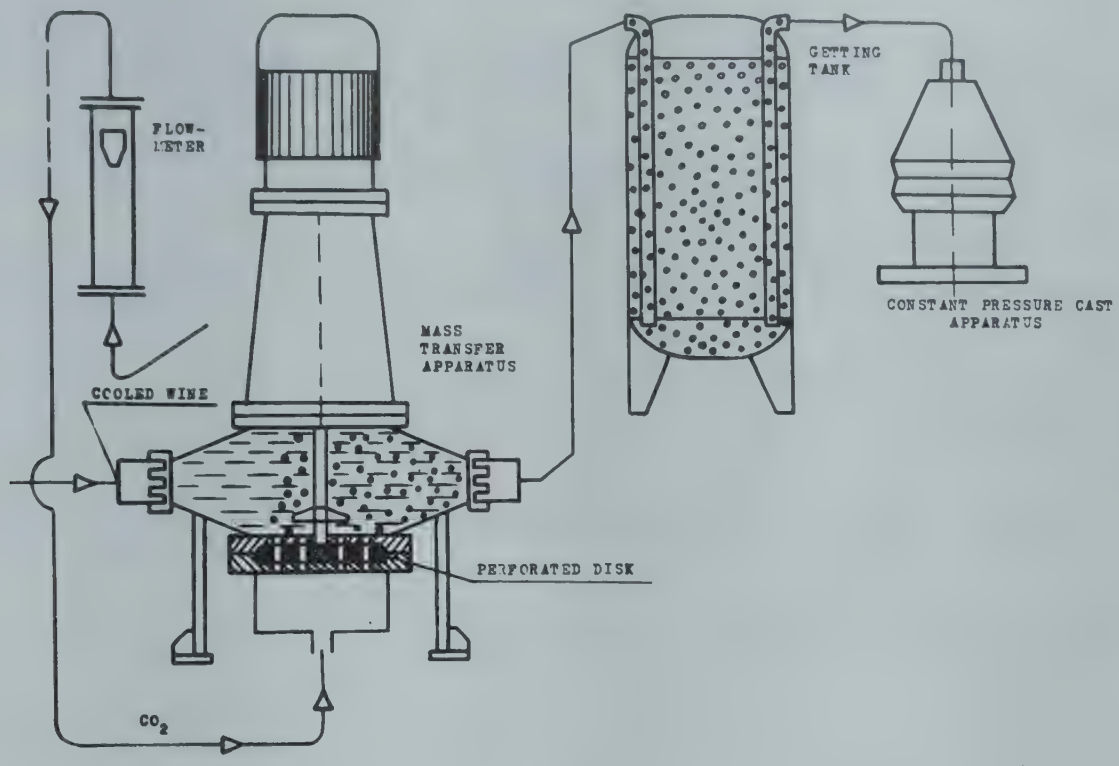
The 'Vacuum emulsifier' has been successfully developed into a milk homogenizer, the schematic of which is shown in Fig. 6. Milk homogenized in



TECHNICAL DATA

Pump capacity; m^3/s	0.027 - 0.054
Air pressure, MPa	0.5-0.7
Outlet oxygen concentration in water, g/m^3	15 -20
Saturation with oxygen, kg/Kwh :	
- Without agitation	2.5
- With agitation	5.0
Coverage Area, hectares :	
- Without agitation	1-2
- With agitation	5
Dimensions, mm	1960 x 1600 x 1800
Mass, kg	800

Fig. 3 The ADE - 100 Aerator using a rotating-disc disperser



TECHNICAL DATA

Wine ouput, kg/h	10
Pressure in saturator, kPa	300-500
Pressure of Co_2 in bottles at 20^0C, kPa	200-450
Dimensions, mm	470 x 350 x 980
Mass, kg	105

Fig. 4 Continuous carbonation of wine

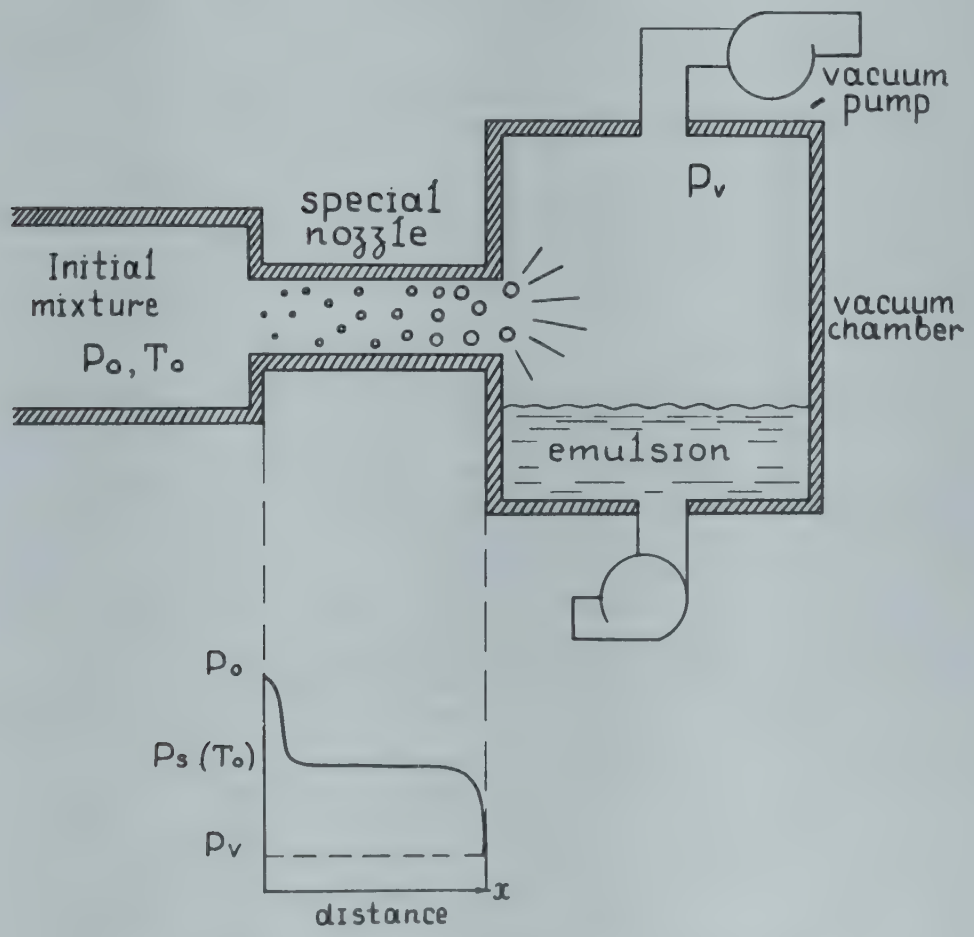
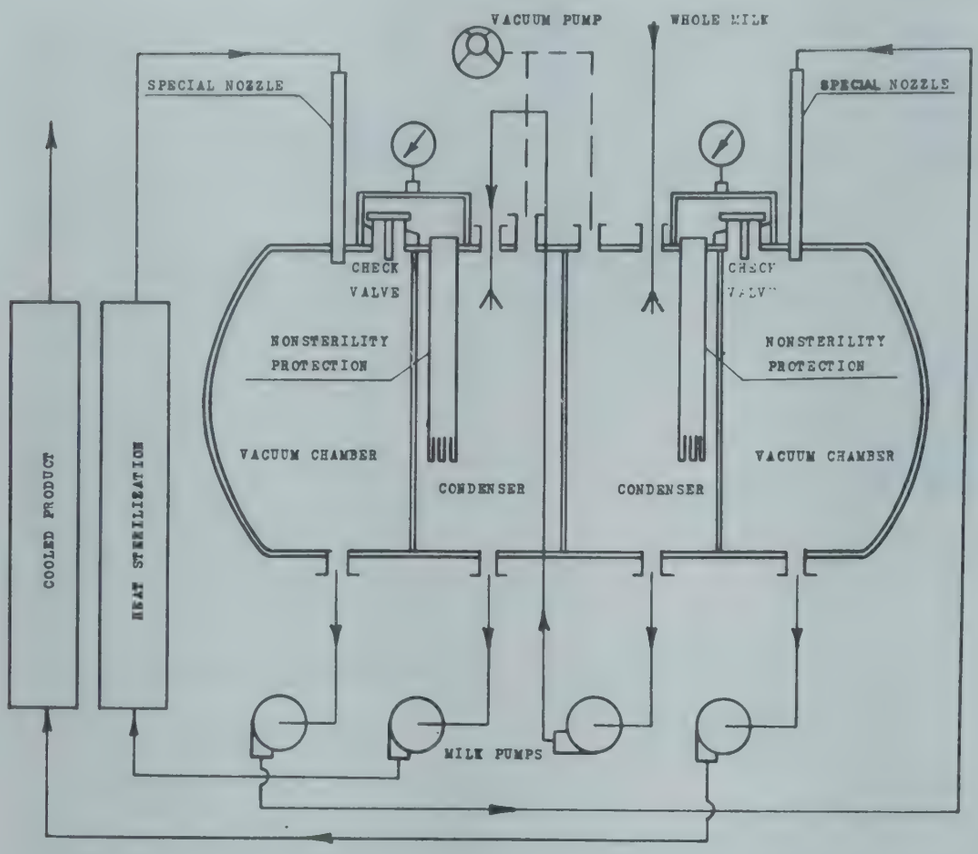


Fig. 5 Emulsification by vaporization under vacuum



TECHNICAL DATA

Capacity, t/h	5
Consumed power, kW	12.5
Pressure in vacuum Chambers, kPa	5-20
Homogenization temperature, ^{0}C	80-90
Homogenization steps	2
Homogenization degree, %	70
Fat ball size, µm	2
Water consumption, t/t	1
Dimensions, mm	1900 x 1100 x 1700
Mass, kg	800

Fig. 6 The vacuum emulsifier as a dairy homogenizer

this 5,000 l/h unit has an average fat globule size of 1.5-2 microns which is indicative of satisfactory homogenizing efficiency. With careful control of the whole process, the need of post-homogenization heat treatment can be obviated. When used in a direct-injection ultra-high temperature (UHT) processing line for milk, this homogenizing device, if operated under aseptic conditions, can also substitute for the flash chamber required to remove excess water. However, the potential of this device in down-stream homogenization of UHT milk has yet to be tested.

The practical applicability of this new technology can be seen from the fact that an Indian equipment manufacturer has adopted the design of the vacuum homogenizer and recently supplied a unit to a Bombay dairy plant for commercial operation.

Conclusion

The discrete pulse energy input or DPEI principle has been incorporated into various processing equipments useful for various food industry operations such as emulsification, dispersion and aeration. Among other DPEI devices being currently tested in the first author's laboratory, are extractors for biologicals of plant and animal origins.

Besides the application-specific advantages, the major advantage associated with all these devices is their considerably reduced energy requirements. In case of the DPEI emulsifying device meant for milk etc., an added advantage would be the needlessness of frequent repairs or replacement of the expensive valve of the conventional homogenizer.

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Gamma-Glutamyl-Transpeptidase (GGTP) - A New Indicator for Pasteurization

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Introduction

There are an increasing number of reports worldwide on foodborne illnesses every year. *Listeria monocytogenes, Campylobacter jejuni, Escherichia coli* and *Yersinia enterocolitica* have been some of the common and important foodborne pathogens. They have been viewed as pathogens of emerging public health significance because of their ubiquitous nature and their ability to tolerate adverse conditions. They are also responsible for several food poisoning outbreaks associated with various dairy products (Farber *et al.*, 1988; Stern and Kazmi, 1989; Doyle and Padhye, 1989; Doyle, 1991; Bradshaw *et al.*, 1991; Ganesh Kumar and Singh, 1994). Investigations into the causes of these outbreaks in milk revealed that improper or insufficient processing and post-processing contamination were one among the probable causes. To keep check of the above problems, there is a need to adopt an efficient indicator of pasteurization.

Limitations in the Use of Alkaline Phosphatase as Heat Indicator

There are number of enzymes, viz., alkaline phosphatase, lactate dehydrogenase, malate dehydrogenase, beta-glucosidase, acid phosphatase, ribonuclease, lysozyme, xanthine oxidase, gamma- glutamyl transpeptidase, that are naturally present in milk (Kitchen, 1985). For the last many years, inactivation of the enzyme alkaline phosphatase (AP) has been considered as an index of proper pasteurization. Even the alkaline phosphatase test has been widely used in the dairy industry (IDF, 1991) and formed the basis of the definition of pasteurization. However, some problems have been identified with regard to the pasteurization of milk, cream and cream-based products. Various workers have shown that when milk or cream has been heat-treated at temperatures above that required for pasteurization (71.7^{0}C/16 sec), there has been reactivation of the alkaline phosphatase enzyme (Wright and Trammer, 1953; Richardson *et al.*, 1964; Murthy *et al.*, 1976). To overcome this, a modification has been brought out in the AP assay to enable the differentiation between residual and the reactivated AP (McFarren *et al.*, 1960; Murthy *et al.*, 1976). However, false positive results are obtained on analysis, when cream and butter samples were treated to temperature >20^{0}C (Kwee, 1983; McKellar *et al.*, 1988, 1989). Recently, it has been established that the recommended AOAC (1990) method for estimation of

For the last many years, inactivation of the enzyme alkaline phosphatase (AP) has been considered as an index of proper pasteurization.

AP in butter could not differentiate between residual, microbial and reactivated AP (Karmas and Kleyn, 1990). Even the mechanism for the reactivation of AP has not been completely understood. However, it is believed that the beta-isozymes of the AP associated with the membrane of milk fat globule are involved (Copius Peereboom, 1970). Thus, cream and cream-based products are more susceptible to this problem of reactivation. Moreover, this problem can be overcome by pasteurizing cream at temperatures >85^{0}C, which are more than those commonly used for milk pasteurization.

Limitations with the Use of Other Milk Enzymes

Keeping in view of the above problems, work has been carried out to find alternative methods for assessing the extent of heat treatment of milk. Recently, various workers have carried out heat inactivation studies on variety of indigenous milk enzymes (Griffiths, 1986; Andrews *et al.*, 1987). The main objective is to find the stability of those enzymes indigenous to milk towards heat and with a view to find a suitable enzyme that might serve as an indicator for pasteurization of milk. Investigations carried out by Griffiths (1986) on pasteurization treatment for several milk enzymes showed that lactoperoxidase was the suitable enzyme for use as an index for heat treatment. However, in an earlier study, Shidlovskaya (1982) demonstrated that there was not complete inactivation of lactoperoxidase when heated at 80^{0}C for more than 20 sec. Moreover, other studies have shown that there has been reactivation of the lactoperoxidase activity (Kiermeier and Kayser,1960; Woerner, 1961; Griffiths, 1986). However, Andrews *et al.*, (1987) examined the heat stability profile for a number of indigenous milk enzymes and their findings showed that

GGTP (EC 2.3.2.1) is a membrane bound enzyme, with most of its activity localized in the milk fat globule membrane.

gamma-glutamyl transpeptidase (GGTP) was an appropriate enzyme for monitoring heat treatment at 70 to 80^{0}C for 16 secs.

Advantages in the Use of GGTP as a Heat Indicator

The GGTP enzyme has been identified as a suitable enzyme for assessing heat treatments in view of the following features :

1. It can be used for milk, cream and butter.

The level of GGTP activity is initially high in colostrum and a considerable reduction in the activity in milk is found within the first two weeks post partum.

2. It can be inactivated at a slightly higher temperature than the conventional pasteurization temperature, which ensures the complete destruction of microorganisms.

3. There would not be any regeneration of GGTP activity, once activated after pasteurization.

4. Seasonal variation has no effect on GGTP activity.

5. Apart from the initial decrease, GGTP activity remains fairly constant throughout lactation, which is important from the public health view point.

Properties of GGTP

GGTP (EC 2.3.2.1) is a membrane bound enzyme, with most of its activity localized in the milk fat globule membrane. It is believed to be involved in the amino acid transport during lactation (Baumrucker and Pocius, 1978). The properties of this enzyme has been extensively studied (Majumder and Ganguli, 1971; Yasumoto *et al.*, 1978; Baumrucker, 1979, 1980). Table 1 lists various properties of bovine milk GGTP.

The level of GGTP activity is initially high in colostrum and a considerable reduction in the activity in milk is found within the first two weeks post partum. However, the levels of GGTP activity remain same after this initial decrease (Majumder and Ganguli, 1972). The average levels of GGTP for whole and skim milk were found to be 4.30 and 3.11 µmol/min/ml, respectively. On an average, the activity of GGTP in skim milk was 72 per cent of that found in whole milk. There was no marked effect of seasonal variation on GGTP activity on either whole or skim milk (McKellar *et al.*, 1991).

Methodology of GGTP assay

Principle

The GGTP enzyme acts on a specific substrate,

Table 1. Properties of bovine milk gamma-glutamyl transpeptidase

Property	Comments
pH optimum (γ-glu-p-NA)[a]	9.0 (H_2O as acceptor) 8.5 (glycylglycine as acceptor)
Temperature optimum	45^0C
Molecular weight	
Native	80,000 (after papain treatment)
Subunits	55,000 and 25,000 (glycoprotein)
Isoelectric point (pH)	3.85
Inhibitors[b]	
Metals	Cu^{+2}, Fe^{+3}
Iodoacetamide	Strong effect
DFP	Strong effect
pCMB	No effect
EDTA	No effect
L-serine/borate	Strong effect
2,3-Butanedione/ borate	Strong effect

[a] Substrate g-glutamyl-p-nitroanilide
[b] DFP, diisopropyl fluorophosphate
pCMB, p-chloro-mercuribenzoate
(Adapted from Kitchen, 1985)

gamma-glutamyl-p- nitroanilide and transfers the glutamyl group to the receptor, glycyl-glycine and releases p-nitroanilide. This released p- nitroanilide is diazotised to form a pink azo dye, which is subsequently quantified spectrophotometrically and the concentration of which is proportional to the GGTP activity.

Gamma-glutamyl-p-nitroanil ide + Gly-Gly --> gamma-Glu-Gly-Gly + p- nitroanilide

Procedure of GGTP assay

GGTP activity can be measured spectrophotometrically as described in Fig. 1. Presently, a commercial test kit is also available and is marketed by Sigma (Sigma Chemical Co., St. Louis, MO, USA).

Conclusions

The assay of AP has been widely used till date as a statutory measure for effective pasteurization of milk. However, keeping in view the current interests being focussed towards the reactivation of AP in various dairy products and also the trend towards the more severe heat treatments, requiring a less labile enzyme system for routine assay, the GGTP has been considered suitable as a pasteurization indicator. This assay of GGTP has been found useful for dairy products which are heated at 79^0C.

This assay of GGTP has been found useful for dairy products which are heated at 79^0C.

In the recent years, this method has been successfully applied for the monitoring of heat treatments of various classes of dairy products, as applicable in case of ice cream mixes (Carter *et al.*, 1990). Moreover, various studies have shown a good correlation between the inactivation of GGTP activity and destruction of pathogens (Carter *et al.*, 1990; McKellar *et al.*, 1991; Patel and Wilbey, 1994). Extensive studies are still required in this area to modify the assay procedures as applicable to different types of dairy products for its routine use as a quality control method.

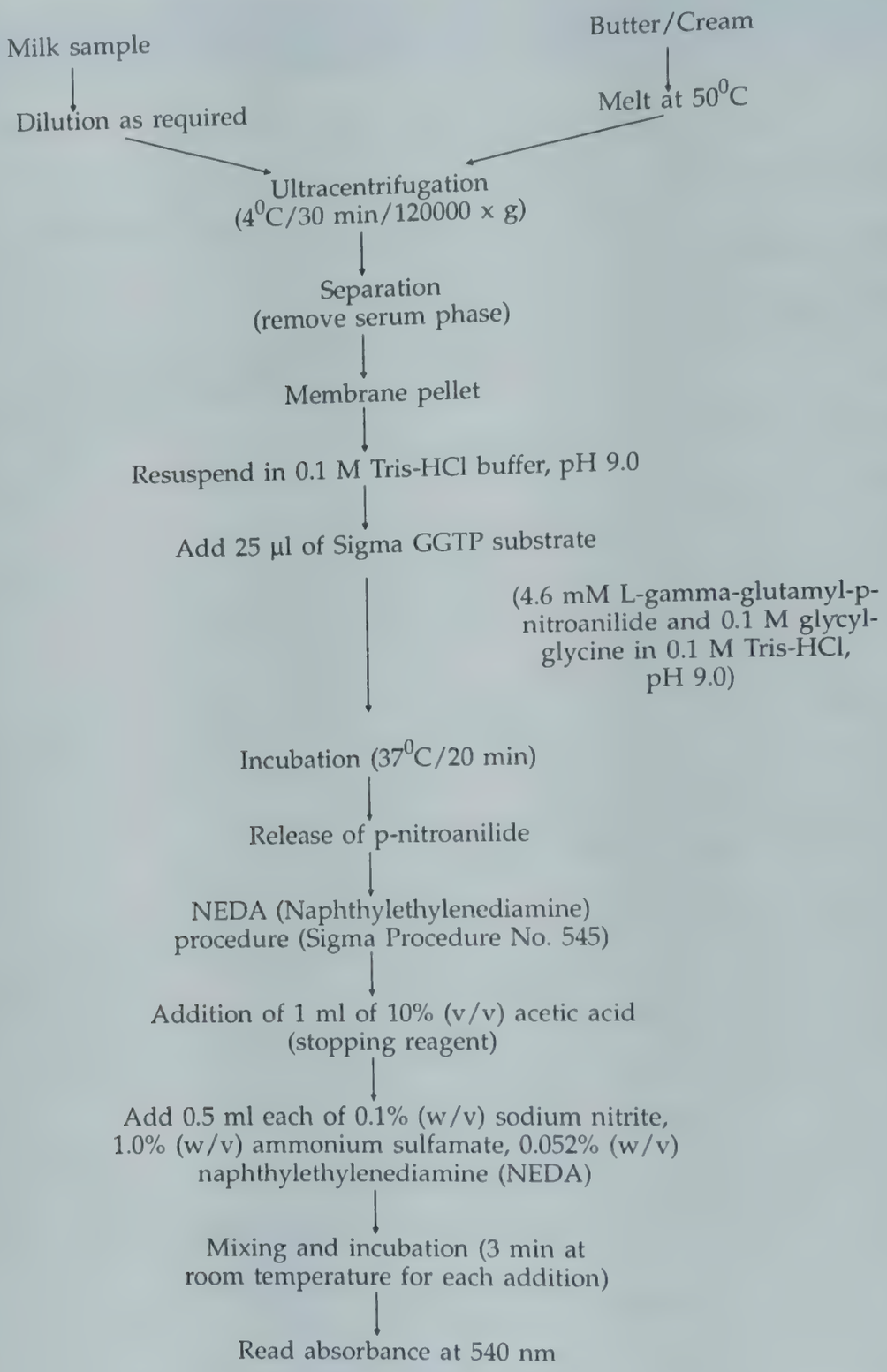
Milk sample
Butter/Cream
Dilution as required
Melt at 50^{0}C
Ultracentrifugation
(4^{0}C/30 min/120000 x g)
Separation
(remove serum phase)
Membrane pellet
Resuspend in 0.1 M Tris-HCl buffer, pH 9.0
Add 25 µl of Sigma GGTP substrate
(4.6 mM L-gamma-glutamyl-p-nitroanilide and 0.1 M glycyl-glycine in 0.1 M Tris-HCl, pH 9.0)
Incubation (37^{0}C/20 min)
Release of p-nitroanilide
NEDA (Naphthylethylenediamine) procedure (Sigma Procedure No. 545)
Addition of 1 ml of 10% (v/v) acetic acid (stopping reagent)
Add 0.5 ml each of 0.1% (w/v) sodium nitrite, 1.0% (w/v) ammonium sulfamate, 0.052% (w/v) naphthylethylenediamine (NEDA)
Mixing and incubation (3 min at room temperature for each addition)
Read absorbance at 540 nm

Fig. 1. Protocol for GGTP assay

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Rapid Chilli Drier at PHTC, Bapatla

A simple, low-cost, small capacity and versatile batch dryer, using agricultural waste as fuel has been fabricated at the Post- Harvest Technology Centre, Bapatla. The dryer consists of a blower, furnace with a heat exchanger and a set of 10 drying trays.

Drying red fresh chilli fruits is an important post-harvest operation to increase their shelf-life, quality and appearance. Harvesting chillies at physical maturity minimises field losses compared to that at dead-ripe maturity. Moisture level during harvest is as high as 70-80 per cent (w.b) and this makes it susceptible to insect and fungal attack.

The conventional method of drying in the sun requires 12-15 days, involves more labour and space and is hampered by the inclement weather. Hence mechanical drying is sometimes preferred.

A Continuous Cashewnut Sheller

A continuous cashewnut sheller is developed to overcome the problems of manual shelling which is presently prevailing in the cashewnut processing industry in India. Manual shelling of cashewnuts is time consuming, tedious and labour intensive. The average shelling rate is reported to be 8 kg per person per day. The power operated cashewnut sheller, developed at AICRP on Post-Harvest Technology ICAR funded project at IIT Kharagpur, has a capacity of 18 kg/h of roasted nuts. The results in terms of whole, half-split and brokens are in the proportion of 50, 22 and 28 per cent, respectively. The maximum shelling efficiency is observed to be 70%. The mechanical shelling not only improves the output but also helps in ease of operation.

For details contact :

Dr. R.K. Jain or Dr. Sivala Kumar

HPHT (ICAR) Scheme,

Post-Harvest Technology Centre,

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Plate Evaporators for Heat Sensitive Material by Praj

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The Plate Evaporator range from Praj includes ECOVAP - Rising/Falling Film Plate Evaporators, Falling Film Plate Evaporators, Ecovap PV and Ecovap PF for application in fruit juice concentrate, milk, gelatin, food and beverage.

The Ecovap PF designed to operate as a forced circulation, suppressed boiling evaporator is ideal for products that crystallize during concentration or those with a high percentage of suspended solids like distillery effluent, grape juice, brewer's yeast (suspended solids), chemical wastes etc.

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* UM 24, UM 44 Universal : 45 litre, 30 kg/b, 4/5.5 KW

* UM 12S, KG 160 S Kitchen : 1.4/1.8 KW

* UM 12D Universal : For Rapid Mix Test on Flour

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RESEARCH ROUND-UP

CSIR - Vision 2001

The Council of Scientific and Industrial Research (CSIR) has set an 'ambitious' goal of earning $ 50 millions annually from global research and development services by the year 2001. The present earnings of the research body total $ 2 millions.

The plan, called 'CSIR Vision-2001' is expected to make CSIR a major technology provider, self-financer and holder of over 500 foreign patents.

Action will be initiated to convert CSIR into a model for scientific and industrial research; provider of high-quality science-based technical services, global R&D platform; a lead player in India in major societal mission and a path-breaker in the shifting paradigm of self-financing.

'Vision-2001' has been intensely debated. To begin with, Singapore-based companies and scientific Institutions and about 50 enquiries have been made in the last couple of months. The $ 130,000-contract bagged by the Bangalore-based National Aerospace Laboratories (NAL) from Boeing has further given a boost to CSIR's plans.

CSIR has already signed umbrella agreements with trade bodies such as FICCI, and ICICI to promote its technologies with the industry.

According to Director-General CSIR, the marketing teams in all laboratories, identifying best five projects with research teams in each laboratory are to be given a push. They would look for prospective industries which can join in the technology development from scratch.

CSIR faces the problem of scientific manpower. The average age of its 5,500 strong scientific pool is 47 and the apex research body is not attracting young scientists.

Research associates and doctoral students are being hired on- campus interviews and attractive packages are being offered to attract young scientists as envisaged under Vision - 2001.

Apple-pear Hybrid Fruit Developed

A hybrid fruit with both the soft texture and juiciness of the indigenous 'Nashi' pear and the sweet taste and ability to preserve for long periods-typical of apples has been developed, according to a Japanese agricultural expert.

The first fruit of the new hybrid have just been harvested, said Kiyoshi Banno, Assistant Professor at Shinshu University in Nagano, Central Japan.

The fruit, which still has no name, was developed by fertilising 'Nashi' pear trees with apple pollen. The result is a fruit said to be sweeter and more fragrant than ordinary 'Nashi' pears and can be preserved for as long as apples. It could be introduced to the market in about four or five years.

Banno's work yielded about 100 fruits weighing around 170-180 grams each from 10 "Osa 20th century" Nashi trees that were cross-fertilised with three different kinds of apples.

"The fertilising worked much better than expected. I hope to grow bigger fruit next year by grafting the tress," Banno said.

Compared to ordinary Nashi pears, the new fruit can be harvested at an earlier date and has a higher sugar content.

BARC Develops Technology for Preparing Invert Sugar

A process technology for preparing invert sugar and for its use in the preparation of concentrated (60-80 per cent) invert sugar syrups has been developed by scientists at the Bhabha Atomic Research Centre (BARC).

This is the first biotechnology-based process for producing concentrated invert sugar. Invert sugar is a valuable sweetener in food and pharmaceutical industries because of low cariogeneity, high osmotic pressure and high solubility compared to sucrose. It also finds wide applications in beverage industry, canned foods and bakery. It is extensively used on manufacturing of syrups in pharmaceutical applications and in the diets of infants. Based on the end use, BARC has standardised three different

processes for industries with varying capacities.

Soft Drink Developed from Matured Coconut Water

A new process has been developed at the Regional Research Laboratory, Thiruvananthapuram, to preserve mature coconut water as a soft drink and upgrade it to the level of tender coconut water. The technique can preserve good quality bottled coconut water with adequate shelf-life at ambient temperatures.

Commercialisation of coconut water will give good returns to farmers who maintain coconut gardens. Matured coconut water contains many minerals and is also recommended for specialised food products such as 'Coconut Salad', which is becoming popular in Kerala.

The National Institute of Science and Technology of the Philippines has developed a product from matured coconut water called 'nata de coco'. Coconut water has proved to be an excellent medium for the production of protein foods.

The Tropical Institute, London, has concentrated on using the food yeast, *Saccharomyces fragilis*, as part of an attempt to grow food yeasts with coconut water. *Saccharomyces fragilis* grows reasonably well in matured coconut water, yielding up to 0.54 gm of dry yeast per gm of total sugar at 40^0C.

Neem Cake as Livestock Feed

The seed cake is used widely by farmers as a manure and to coat urea granules to reduce ammonia release. Farmers in parts of Andhra Pradesh feed this cake in restricted amounts to livestock.

The decortication of whole seeds followed by oil extraction yields kernel cake which is highly proteinaceous. It is a balanced feed as it contains crude protein (34-36%), crude fibre (11-14%), soluble carbohydrates (23-28%), calcium (0.75-0.78%) and phosphorus (0.48-0.65%). Its amino acid content is better than a few conventional protein sources.

However studies have indicated undesirable effects on production including changes in vital organs of animals particularly simple stomached ones due to prolonged feeding of neem cake. Water washing of the cake, though yielded better results in removing the bitter principles, resulted in the loss of certain essential nutrients.

As an alternative, researchers at the IVRI have developed a simple method of making the cake wholesome. It involves thorough mixing of one kg of cake in 1.2 litres of water in which fertilizer grade urea (30 g/kg cake) has already been dissolved. The semi-solid slurry, so prepared is ensiled in an air tight container for five days.

The ammonia liberated from urea neutralises the neem bitters and improves palatability. The wet cake as such or after sundrying can be fed to productive cattle and buffaloes. It can be mixed with equal quantities of either rice or wheat bran, molasses, a spoon of mineral mixture and salt to make a complete diet supplying protein, energy and trace elements.

The residual urea or ammonia present in the processed cake is easily digested by the cattle and buffaloes. Adequate dry roughage along with clean drinking water should be provided along with such a feed.

Techniques for White Pepper Production

Technique	Remarks
1. Water steeping	Ripe fresh berries or dried black berries are used
2. Steaming or water boiling	Green fresh berries or dried black berries are used
3. Decortication	Mechanical removal of skin of dried black pepper berries
4. Improved NRDC process	Detailed technical knowhow is available from National Research Development Corporation
5. Improved CFTRI process	Use of a fruit pulping machine combined with a suitable drier
6. Chemical technique	Steeping whole dried black pepper with about 5 time its weight of water for 4 days; treating it with 4% NaOH solution and boiling the mixture etc. This has not been tried commercially.

CFTRI Develops Process Knowhow for Chicken-based Products

The Central Food Technological Research Institute has developed processes for products based on chicken.

1. Chicken Wafers

(i) Dehydrated Wafers ready-to-use and (ii) Fried Wafers ready-to-eat

The product is to be used as a Snack Food. Dehydrated Wafers, (ready-to-use) can be readily fried in any cooking oil and can be used immediately. It could also be sold as fried wafers (ready- to-eat) which can be consumed immediately after opening the pouch.

The product can also be supplied under nutritional improvement program such either growing children in schools or to the malnourished children.

The product may be packed in flexible pouches of low moisture and oxygen transmission.

Expose of transparent package should be reduced to the minimum, to prevent photo-oxidation. The products may be stored at ambient condition avoiding high humidity.

The raw materials required are starch, chicken meat, sugar and salt.

Chicken Meat

Layer or broiler chicken meat, ignoring sex, breed and age of the birds, deboned meat along with skin and fat may be used. Low graded or cheaper meat cuts like wings or neck meat can also be used.

Dressed chicken is deboned and then minced.

Minced meat, water, starch, salt and sugar should be mixed in a heavy duty mixer till a fine thick uniform paste is obtained. This paste is then cooked, cooled and sliced to about 2 mm thickness.

The chicken wafer slices are then dried in perforated aluminium trays.

Equipments required are :

Meat Mincer, Mixer, Cooker, Curing chamber, Slicer, Hot air dryer, Fryer, Pouch sealer.

The product has a shelf-life of one year.

2. Chicken Pickle

CFTRI has also developed chicken pickle and the process description is as follows :

Broiler chicken of appropriate age is selected and dressed under hygienic conditions. The chicken meat is be deboned and cut into 1" to 1.5" size. It is then subjected to marination with calculated quantities of vinegar and salt at fixed temperature for about 18-20 hrs. The marinated meat pieces are then cooked and then fried in gingelly oil. The spice ingredients are also fried in gingelly oil, separately and chopped or minced using a meat mincer. Dry spices like cumin powder, red chilli powder, mustard and turmeric powders and salt are taken and roasted using dry heat on a hot pan. Vinegar and other ingredients are taken in a container and boiled for 5 minutes. All the ingredients are mixed together with low flame heating and kept aside for 24 hours (overnight). The mixed product (chicken pickle) is weighed into clean and dry bottles, (450 gms for each bottle). Fifty ml of mustard or (gingelly) oil is heated to 60^0C and added on the top of the pickle in each bottle. The bottles are then stored at room temperature after closing with lids.

Children pickle is a shelf stable and highly acceptable product.

Plant and Equipment

All the equipment / machinery are indigenously available and there is no sophisticated machinery involved. The principle machinery / equipment involved are :

a. Poultry dressing line

b. Utensils, knives, containers, chill room.

c. Cooking/frying stoves/heaters.

d. Crinding (dry) equipments.

e. Bottle filling devices.

f. Weighing balance.

For details contact :

Director,

CFTRI, Mysore - 570 013

Process for the Preparation of Stable Silage from Fish/ Poultry Processing Wastes

Fish and poultry processing in India generate large quantities of wastes, viz., 300,000 tonnes of fish viscera and 65,000 tonnes of poultry intestine per annum. Presently, these wastes are rejected resulting into serious environmental pollution besides loss of nutrients. Conversion of these proteinaceous wastes into value-added products without creating further pollution not only helps to meet the increasing demand for protein in animal production programmes, but also saves the costs of waste treatment and disposal.

The Process

With a view to preserve/recover the nutrients in offals as feed ingredient, CFTRI has developed a fermentation based process to prepare a microbiologically stable silage from these offals. The process, in brief, involves collection of raw materials, disintegration / homogenisation, addition of molasses, antimycotic agent and antioxidant, effecting fermentation at ambient temperature and autolysis and packaging. The process developed is pollution-free and fulfils the needs of fish and poultry processing industries for waste abatement. Process is based on low-cost, low energy use and is developed taking into account the perishability and non-homogenous nature of the waste.

Plant and Equipment

The process does not need any sophistication and the plant and equipments are simple and can be fabricated indigenously. The major equipments are : disintegrator / homogeniser, stirrers and siloes. The capacity of the plant can be sized according to the raw material availability.

The Product

The silage prepared from the offals is a homogenous paste-like mass. It is free from potential pathogens like *E. coli, salmonella* etc. Packed in plastic containers with air-tight lids, the product can be stored at ambient temperature with a keeping quality of about a month.

Utilisation

The silage can be fed to pigs along with kitchen refuse or it can be mixed with other ingredients of feed formulations, extruded/dried for poultry or aquaculture feeds. The silage as a source of animal proteins (and other nutrients) can replace the conventionally used fish meal in animal diets.

For details on process know-how, plant lay-out and project economics, please contact : The Director, CFTRI, Mysore - 570 013.

AWARDS

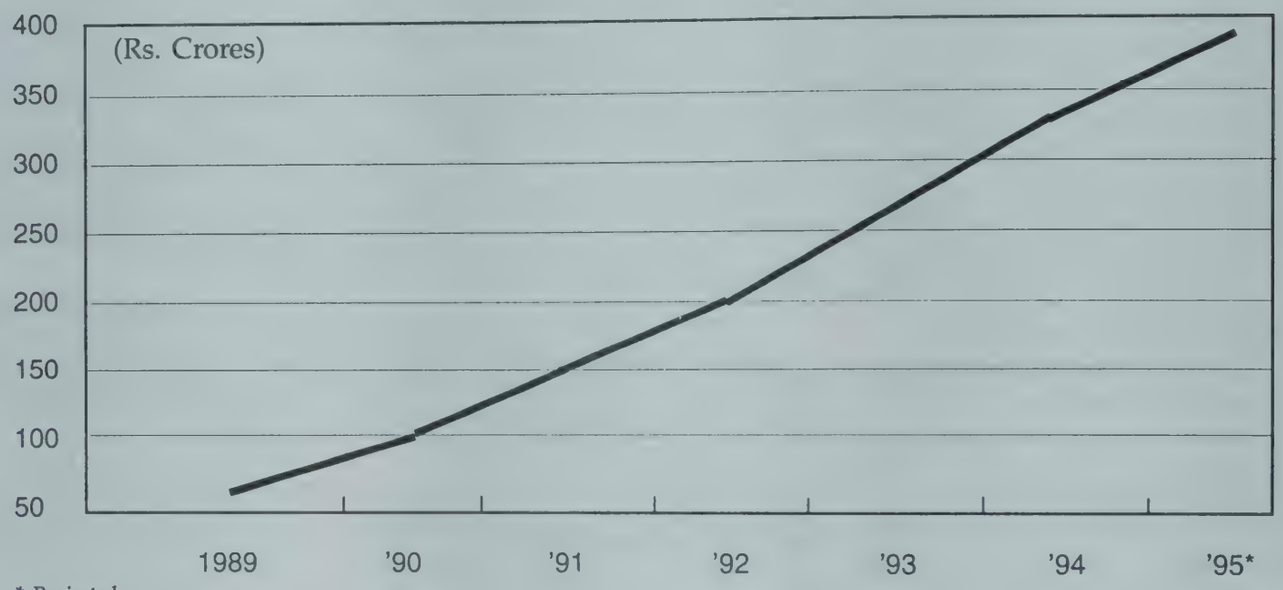
K.U. Patel Memorial Award

Dr. M. Mahadeviah, Head, Packaging Technology Department, C.F.T.R.I, Mysore, received the K.U. Patel Memorial Award from Mr. K.P. Singh Deo, Union Minister for Food Processing Industries on 6th December 95 at New Delhi in the annual conference of All India Food Preserver's Association.

The award was given to the Research paper entitled "Influence of some edible corrosion inhibitors to inhibit corrosion in food cans" published in *Indian Food Packer* during 1994, by Dr. M. Mahadeviah, Mrs. R.V. Gowramma, Mr. R. Naresh and Mr. S.M. Pandian, which has been adjudged as the overall best paper among about fifty papers published for its useful application to Food Processing Industry.

DATA BANK

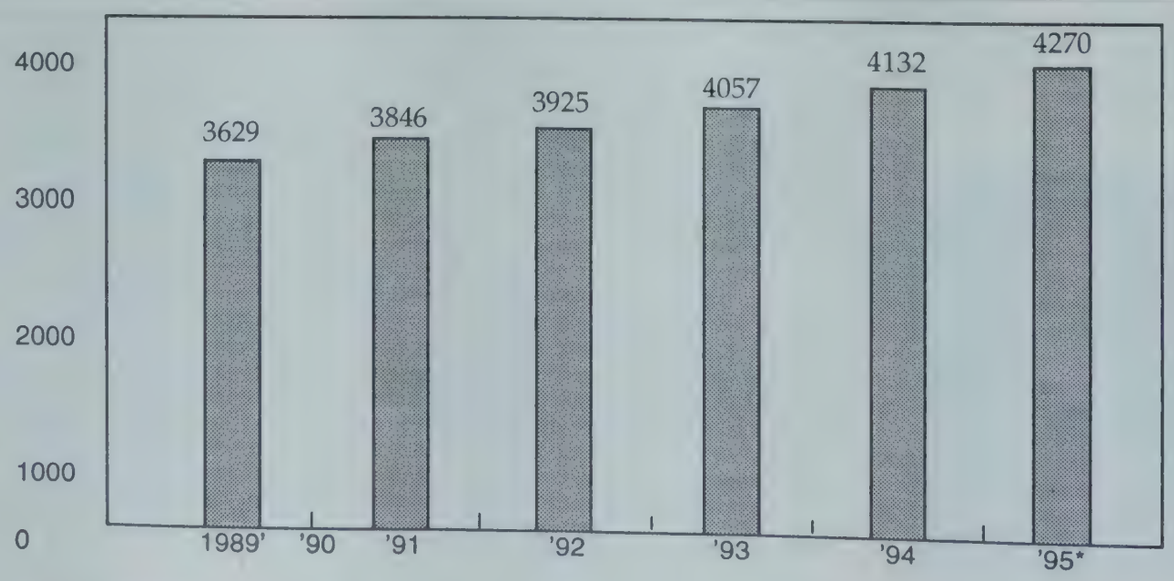
Export of Fruit & Vegetable Products (including dried Walnuts)



* *Projected*

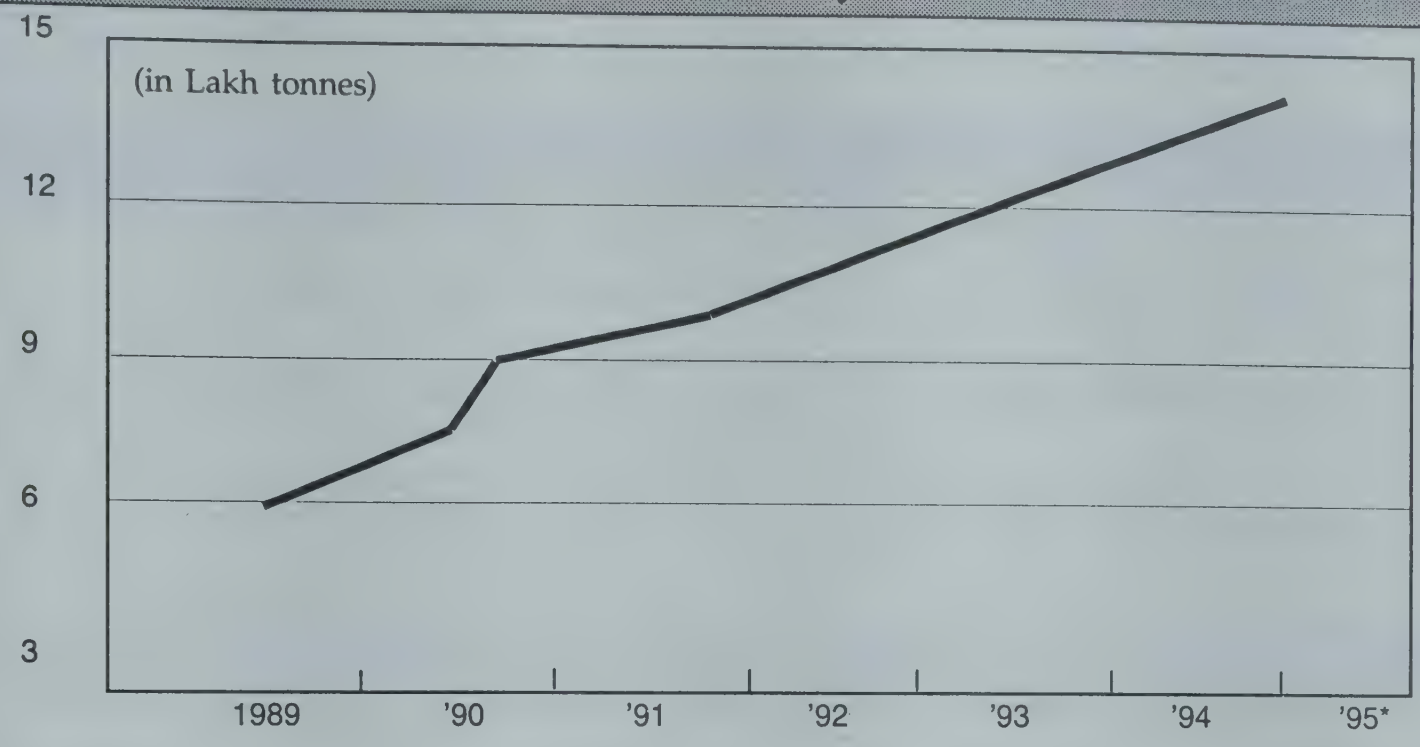
Source : Businessline 26 Nov.'95

Number of Licenced Units under FPO

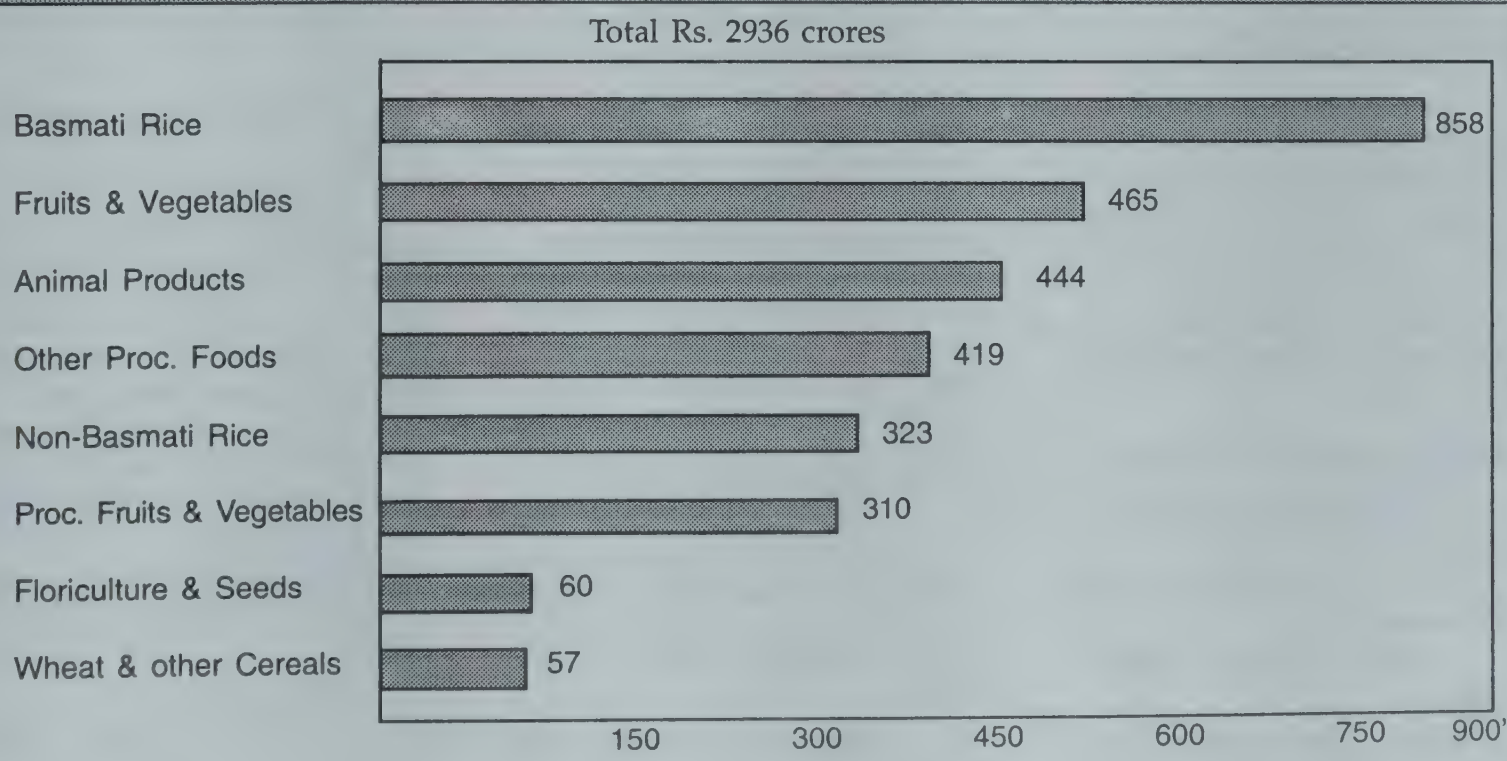


Source : Businessline 26 Nov.'95

Installed Capacity of Fruit and Vegetable Products Industry



Export of APEDA - Products (1994-95)



Continued on page 57

TRADE FAIRS & GET-TOGETHERS

Short-term courses to be conducted by CFTRI

The Central Food Technological Research Institute, will conduct the following short-term courses during March-May 1996.

04 Mar '96 to 15 Mar '96	Aflatoxin Analysis in Foods and Feeds
04 Mar '96 to 15 Mar '96	Advances in the Technology of Oilseed Processing with an Emphasis on Indigenous Technology
18 Mar '96 to 29 Mar '96	Recent Trends in Food Analysis & Quality Control
01 Apr '96 to 12 Apr '96	Food Contamination from Plastics Packing Materials and their Evaluation
15 Apr '96 to 26 Apr '96	Technology of Biscuits Manufacture
30 Apr '96 to 03 May '96	Engineering Properties of Foods

For details, contact :
Director,
CFTRI, Mysore - 570 013

FIEO Fairs

The Federation of Indian Export Organisations (FIEO) is organising 'India Expo' fair in Morocco from 24th to 28th April 1996. There will be no limitation on the number or kind of products or services that can be displayed. The other details are given below.

India Expo in Morocco

Date of Exhibition : 24th April-28th April 1996

Total available area : 3768 sq. metres

Area for Exhibit : 1800 sq. metres

Size of the Stalls : 9 sq. metres (Less than 9 sq. metre is also available on sharing basis)

Rate per sq. metre : Moroccan Dirhams 670 per sq. metre or US $ 80 (for 5 days)

The Federation recently sponsored a high powered delegation to the United Arab Emirates (UAE). The delegation identified Dubai as one of the important entrepot for Indian goods to other destinations in the Middle East, East Europe, Africa and other West European countries. During its visit, the federation was approached by one of the co-organisers of the "Middle East World Trade Fair" to participate in the event at Dubai. The fair, which is supported by the Government of of Dubai, will be held as follows :

Middle East World Trade Fair

Date : 25th February - 2nd March 1996

Venue : Dubai World Trade Centre, Dubai (UAE)

Minimum Stand size : 9 Sq. metres

Actual Stand Rate : US $ 400 per sq. metre

The Middle East World Trade Fair will feature more than 30 countries from across the world, showcasing a variety of goods and services. Some of the product categories covered in the event are communications and electronics; consumer products; engineering; construction; agricultural products; chemicals and allied products; oil and gas; manufacturing industry; hotel and tourism etc.

Interested exhibitors may contact FIEO, New Delhi for further queries.

(Tlx : 031-73194,
Fax : 91-11-6863087, Tel : 6851310)

5th International Mango Symposium at Tel Aviv, Israel (September 1-6, 1996)

The 5th International Mango Symposium will be held in Tel Aviv, Israel from September 1-6, 1996.

The symposium will cover all aspects of the mango industry including research, extension, management and marketing. The scientific programme will consist of plenary lectures, workshops, panel discussions and informal meetings. The five day programme will also include poster sessions and professional tours.

The main topics include (i) Botany and taxonomy (ii) Genetics and breeding, (iii) Biotechnology, (iv) Physiology and reproductive biology (v) Diseases and pest control (vi) Propagation and nursery practices (vii) Horticultural practices (viii) Post- harvest aspects and (ix) Shipping, marketing and economics.

For more information, contact :

Secretariat

5th International Mango Symposium

P.O. Box 29041,

Tel Aviv - 61290, Israel

DATA BANK ..... Continued from page 55

Farm Products Exports

Commodity	1992-93	1993-94	1994-95
Rice	975.60	1286.71	1181.21
Wheat	10.21	0.21	30.85
Other Cereals	10.16	34.02	25.67
Spices	393.42	568.91	606.48
Cashew	748.66	1048.20	1244.26
Sesamum & nigerseed	116.22	73.51	142.24
Groundnut	7.72	171.12	98.64
Oilmeals & guameal	1648.67	2464.74	1937.49
Sugar & molasses	353.51	178.08	62.09
Fruits & vegetables	812.63	1061.22	1289.05
Spirit & beverages	41.65	46.01	45.81
Pulses	53.44	73.58	90.36
Total	**5686.80**	**7532.98**	**7049.04**

Source : DGCI&S, Calcutta

PEOPLE

Dr. (Mrs.) Rugmini Sankaran

Dr. (Mrs.) Rugmini Sankaran, Director, Defence Food Research Laboratory, has taken over the position of President of the Association of Food Scientists and Technologists (India) on September 9, 1995 at a function organised on the concluding day of ICFoST '95 at the IFTTC Auditorium of the Central Food Technological Research Institute, Mysore.

Dr. Sankaran, born on September 10, 1935, at Trichur in Kerala, had her early education in her native place and later obtained her doctoral degree in Ecology from the prestigious Banaras Hindu University, U.P., in 1960. Her interest for research made her join the Defence Research Development Organisation, relinquishing her first assignment as a lecturer at the Banaras Hindu University. Dr. Sankaran had Advance Training in Food Microbiology in U.K., at the University of Surrey.

Dr. Sankaran's several contributions include, development of a number of techniques and standards in food microbiology, and also development of convenience foods especially from traditional foods for their preservation and packaging and the development of an ecological method for the extension of shelf-life of meat. She has also designed and conducted several training courses in Food Science and Technology.

Dr. Sankaran has played a crucial role in the successful transfer of technology for a number of convenience foods to private entrepreneurs. She has achieved significant success in popularising science, specifically food science through a number of seminars, workshops, expositions, radio talks and TV programmes within India and abroad.

Dr. Sankaran has published about 170 research papers and technical reports including contributing chapters to two books. A very principled, committed hard working person that she is, Dr. Sankaran's several contributions in food science are reflected in the various awards and honours she has received, including the outstanding woman professional award by Federation of Indian Chambers of Commerce and Industry (FICCI-FLO). She led an Indian delegation to Common- wealth Defence Scientists Organisation (CDSO) conference held in Kuala Lumpur, Malaysia in 1988.

Dr. Sankaran has also been an examiner of M.Sc. and Ph.D. candidates at the Universities of Mysore, Nagpur, Bombay, Mangalore and the University of Agricultural Sciences, Bangalore. She has been a member of various Committees of Bureau of Indian Standards (BIS) and Central Committee for Food Standards (CCFS) (Directorate General of Health Services) and has also been a member of Task Force on Agro-food Processing, Technology Information and Forecasting Assessment Council (TIFAC) Chairperson, vegetable panel and member, Department of Biotechnology (DBT) Task Force on Food Biotechnology.

Dr. Sankaran, had a distinguished tenure as the Director of DFRL for about six and half years before attaining superannuation on 30th September 1995. She is also an able administrator. She is not new to the AFST(I). She has been its member since 1969, and had the privilege of serving as its Vice-President (Hq), during 1982-83. She was President, Association of Microbiologists (India) during 1993-94. Under her able stewardship, the AMI conducted an International Conference MICON-94, at the DFRL in Mysore, which was attended by over 850 delegates from India and abroad. The proceedings of this conference has been published in September 1995 as a book entitled 'Microbes for Better Living'.

AFST(I) and editors of this journal take the privilege to welcome and wish Dr. Sankaran and her new Central Executive Committee members all success.

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JOURNAL OF FOOD SCIENCE AND TECHNOLOGY

Volume 33 Number 1 JANUARY/FEBRUARY 1996

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